The Welding Engineer

Founded by L. B. Mackenzie, 1916

OCTOBER, 1926 — VOL. 11, No. 10

$3.00 per year in U. S. — 608 S. Dearborn St., Chicago, Ill. — Reg. U. S. Pat. Office — $4.00 per year abroad

An Airco-Davis-Bournonville Welding Torch

Style 7700

Combining All Essentials of Efficiency
Including Low Initial Cost
Economical Operating Cost and
Small Maintenance Cost

This Welding Torch combines the factors that established and maintained the high reputation of Davis-Bournonville Torches from the beginning of Oxyacetylene practice, with many new features of appreciable advantage and economy to the welder.

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Manufacturers of Airco Oxygen, Airco Acetylene, Airco Calorene, Airco-National-Carbide Airco-Davis-Bournonville Welding and Cutting Apparatus and Supplies

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Home Office, 342 Madison Ave., New York City

Published monthly by the Welding Engineer Publishing Co. Entered as second class matter Jan. 29, 1916, at the Post Office at Chicago, Ill. Under the Act of March 3, 1897.

Maybe Oxweld equipment is too well made ~

That's what an advertising man said when we showed him the list of Oxweld blowpipes that have been in service seven, eight, ten, twelve and even fourteen years.

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Reliable Results are Required
When Welding Pipe Lines
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With Airco Gases and Airco Apparatus
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Your Oxygen On
Specification For Purity
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PURE IN THE CYLINDER
The Purest Oxygen Is
Always the Most
Economical
OXYGEN
CALORENE
AIRCO
ACETYLENE
CARBIDE
AIRCO-DAVIS-BOURNONVILLE APPARATUS
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17 DISTRICT OFFICES
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NEW YORK, N.Y.

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Booklet 33 points out more advantages. Write for it now!

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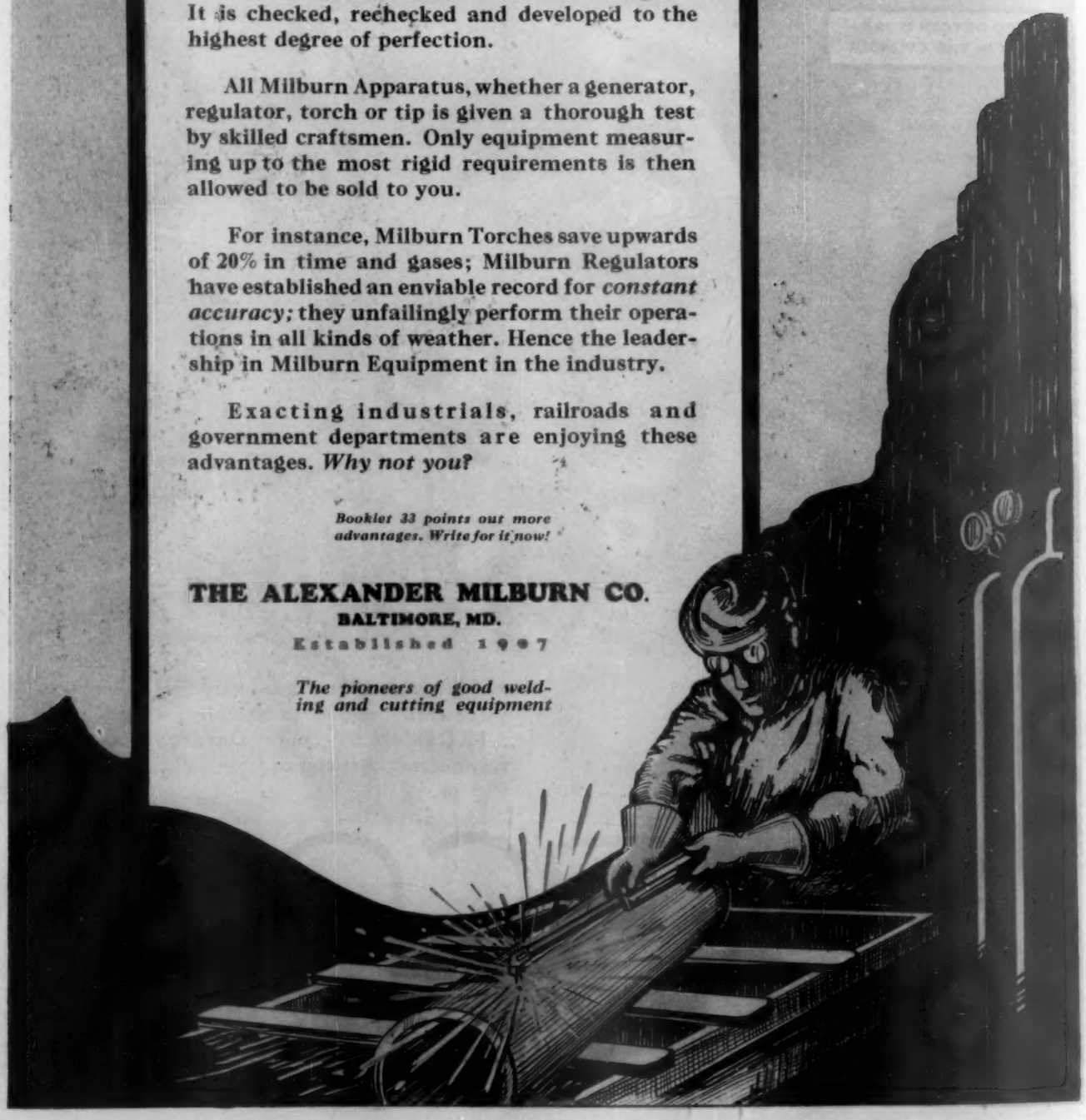
The pioneers of good welding and cutting equipment



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Ask the Professor

EDUCATIONAL work is more often concerned with methods than with materials, the general idea being to find out how to get the best results with the materials on hand. There is a way, however, to study and keep posted on the progress that is being made in the production of better things to work with. The easiest way is through careful reading of the advertising section of your business paper. When something new is ready for the market, something that will solve your particular probelm, the quickest way to get the news in your hands is through these pages. When it's a question of what to buy and where to buy it, ask the professor. In other words, consult the advertisements in your business paper. Keeping these pages full of new market information for you is the greatest service your paper can give you.

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The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

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Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

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Air Reduction Sales Co.
Commercial Acetylene Supply Co.
International Oxygen Co.
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ASBESTOS INSULATED WIRE AND CABLE
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BLOW PIPES
See "Torches."

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Torchweld Equipment Co.
U. S. Welding Co.

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Wodack Electric Tool Corp.

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See "Electric Resistance Welders"

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Allan Mfg. & Welding Co.
Electric Arc Cutting & Welding Co.
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corp.
Lincoln Electric Co.
Quasi-Arc Weldtrode Co.
Seneca Electric Arc Welder Co.
Una Welding and Bonding Co.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co.

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Shawinigan Products Corp.
Union Carbide Sales Co.

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Electric Arc Cutting & Welding Co.
Harris Calorific Co.
National Carbon Co.
Oxweld Acetylene Co.

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Torchweld Equipment Co.

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Lincoln Electric Co.
National Carbon Co.
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Westinghouse Elec. & Mfg. Co.
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Pressed Steel Tank Co.

CYLINDERS (Oxygen, Hydrogen)
Wm. Wharton, Jr. Co.

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Wodack Electric Tool Corp.

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General Electric Co.
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Gibb Welding Machines Co.
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Seneca Electric Arc Welder Co.
R. D. Thomas
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Wilson Welder & Metals Co.

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General Electric Co.
Gibb Welding Machines Co.
Goodman Electric Machinery Co.
R. D. Thomas

ELECTRODES (Carbon Arc Welding)
See "Cutting Electrodes"

ELECTRODES (Metallic Arc Welding)
Alloy Welding Processes
American Compound Co.
Central Steel & Wire Co.
Chicago Steel & Wire Co.
Cuyahoga Steel & Wire Co.
Electric Arc Cutting & Welding Co.
General Electric Co
Gibb Welding Machines Co.
Lincoln Electric Co.
Lincoln Steel Co.
Morris-Wheeler Co.
Page Steel & Wire Co.
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Reid-Avery Co.
Roebling, John A., Sons Co.
Steel Sales Corp.
Seneca Electric Arc Welder Co.
Stulz-Sickles Co.
R. D. Thomas
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Welding Service Co.
Wickwire-Spencer
Wilson Welder & Metals Co.

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C. H. Hollup Corp.
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Owen Electric Mfg. Co.
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Una Welding and Bonding Co.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co.

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Elkon Works, Inc.

ELECTROLYTIC OXYGEN AND HYDROGEN GENERATING EQUIPMENT
International Oxygen Co.

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Aluminum Fix Co.
Burke Electric Co.
Chicago Eye Shield Co.
Electric Arc Cutting & Welding Co.
Fibre-Metal Products Co.
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corp.
Ideal Face Shield Co.
Lincoln Electric Co.
Owen Electric Mfg. Co.
Quasi-Arc Weldtrode Co.
Seneca Electric Arc Welder Co.
Strauss & Buegeleisen
Una Welding and Bonding Co.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co.
Willson Goggles, Inc.

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Air Reduction Sales Co.
American Brass Co.
Central Steel & Wire Co.
Cuyahoga Steel & Wire Co.
Oxweld Acetylene Co.
C. H. Hollup Corp.
Lincoln Steel Co.
Morris-Wheeler Co.
Page Steel & Wire Co.
Reid-Avery Co.
Roebling, John A., Sons Co.
Steel Sales Corp.
Seneca Wire & Mfg. Co.
Stulz-Sickles Co.
American Compound Co.
Torchweld Equipment Co.
Wickwire-Spencer
Welding Service Co.
Weldit Acetylene Co.

FIREPROOF PLASTIC MATERIAL
Air Reduction Sales Co.
Joseph Dixon Crucible Co.
National Carbon Co.
U. S. Welding Co.

FLUE WELDERS (Electric)
General Electric Co.

FLUXES
Air Reduction Sales Co.
American Compound Co.
Anti-Borax Compound Co.
Metal & Thermit Corp.
Central Steel & Wire Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
Weldit Acetylene Co.

GAS SAVING DEVICES
Harris-Calorific Co.
U. S. Welding Co.
Weldit Acetylene Co.

GLOVES (Asbestos)
Ideal Face Shield Co.

GAUGES
National Gauge & Equipment Co.
U. S. Gauge Co.

GENERATORS (Acetylene)
Air Reduction Sales Co.
M. Keith Dunham
Imperial Brass Mfg. Co.
Milburn, Alexander Co.
Oxweld Acetylene Co.
U. S. Welding Co.

GOGGLES
Chicago Eye Shield Co.
Ideal Face Shield Co.
Strauss & Buegeleisen
Willson Goggles, Inc.

GRAPHITE (Rods, Blocks, Paste, Etc.)
Joseph Dixon Crucible Co.

GRINDERS (Portable Electric)
N. A. Strand & Co.
Wodack Electric Tool Corp.
Stoody Company

HELMETS (Arc Welding)
Allan Mfg. & Welding Co.
Aluminum Fix Co.
Burke Electric Co.
Chicago Eye Shield Co.
Electric Arc Cutting & Welding Co.
Fibre-Metal Products Co.
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corp.
Ideal Face Shield Co.
Lincoln Electric Co.
Owen Electric Mfg. Co.
Quasi-Arc Weldtrode Co.
Seneca Electric Arc Welder Co.
Strauss & Buegeleisen
R. D. Thomas
Westinghouse Elec. & Mfg. Co.
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Willson Goggles, Inc.

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RACO PROCESSED ELECTRODE

A Brand New Product
from a Brand New Plant.

A Full Coated Electrode
at Bare Wire Prices.

Placed on the market to fill an urgent need by the welding industry for an electrode of absolute uniformity at a price.

This new rod is of .13-.18 Carbon, .40-.60 Manganese with all impurities under .04. This new rod has been developed primarily for direct current welding where bare wire has given uncertain results. Can be used with A. C. as well as D. C. We absolutely guarantee the uniformity and weldability of every rod in a fifty pound package. Prices and samples on request.

RACO COMPOSITE WIRE for Automatic Welding
RACO WHITE LABEL Pure Iron Electrodes
RACO PURE IRON COPPER COATED RODS
RACO MILD STEEL COPPER COATED RODS
RACO HIGH CARBON
RACO NICKEL STEEL
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BALTIMORE,
MARYLAND

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Gas Products Association
International Oxygen Co.

HYDROGEN GENERATING PLANTS
International Oxygen Co.

LEAD WELDING UNITS
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Endress Mfg. Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
Hoke, Inc.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
U. S. Welding Co.
Weldit Acetylene Co.

LIGHTERS (For Gas Torches)
Air Reduction Sales Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Stevenson Distributing Corp.
Torchweld Equipment Co.
U. S. Welding Co.

MANIFOLDS
Air Reduction Sales Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
U. S. Welding Co.

MECHANICALLY OPERATED CUTTING AND WELDING TORCHES
Air Reduction Sales Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.

MOLDING MATERIAL
See "Fire Proof Plastic Material"

MONEL METAL RODS AND ELECTRODE
Central Steel & Wire Co.
Wilson Welder & Metals Co.

NEEDLE VALVES
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Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
U. S. Welding Co.

NITROGEN
Air Reduction Sales Co.
Gas Products Association
Linde Air Products Co.
International Oxygen Co.

OXYGEN
Air Reduction Sales Co.
Gas Products Association
International Oxygen Co.
Linde Air Products Co.

OXYGEN PRODUCTION PLANTS
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Heylandt Sales Co.

PREHEATING DEVICES AND OVENS
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RAIL BONDS
Una Welding and Bonding Co.

RAIL JOINT WELDERS
Una Welding and Bonding Co.

REAMERS (Portable Electric)
N. A. Strand & Co.
Wodack Electric Tool Corp.

REGULATORS
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Endress Mfg. Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
U. S. Welding Co.
Welding Service Co.
Weldit Acetylene Co.

SEAM WELDERS
See "Electric Resistance Welders"

SPOT WELDERS
See "Electric Resistance Welders"

TANK CONNECTIONS
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Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
U. S. Welding Co.

THERMIT WELDING
Metal & Thermit Corp.

TORCHES (Welding and Cutting)
Air Reduction Sales Co.
Endress Mfg. Co.
Harris Calorific Co.
Hoke, Inc.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
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Torchweld Equipment Co.
U. S. Welding Co.
Welding Service Co.
Weldit Acetylene Co.

TRUCKS (Cylinder)
Air Reduction Sales Co.
International Oxygen Co.
Torchweld Equipment Co.

VALVES
Air Reduction Sales Co.
International Oxygen Co.

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Harris Calorific Co.
Joseph Dixon Crucible Co.
National Carbon Co.

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See "Electrodes" and "Filler Rods"

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Ask for a copy of "The Welding Industry"

The Welding Engineer 608 S. Dearborn St., Chicago

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Problems in Production Welding

Problems in Boiler Welding

Problems in Tank Welding

Problems in Structural Steel Welding

Problems in Cast Iron Welding

Have been solved by

"KORO"

WELDING ELECTRODES

Who Will Solve Your Problem?

If you put it in our hands it will get the skilled attention of an engineer who is experienced in welding wire research. Many a welding department is working at higher efficiency today because of this intelligent service.

Since the new improved KORO Electrodes were put on the market they have been adopted by many plants which are nationally known for the high quality of their welding. They were adopted by such plants for one reason, only one reason—because **they solved a problem.**

What is **your** problem? We don't say that KORO Electrodes will solve it. But we know that if KORO Electrodes do solve it, you will want to standardize on KORO. And if KORO can give you this service, we want you for a customer. An inquiry, telling us about your work, will start us working for you.

LINCOLN STEEL COMPANY
2320 W. 58TH ST. CHICAGO

Dealers are coming in fast for exclusive distribution. There is still some open territory available. Write

Welding Cast Steel Contra-Propeller to Rudder Post, Fletcher Shipyard, Hoboken, N. J.

For this weld *below the water line* —Wilson Wire was used!

Use Wilson Type S Machine

Simple, close regulation; a *self-exciting* generator; a commutator that always shows *less temperature rise than any other part of the machine*; a simple, compact control panel; an arc that is easy to strike and easy to maintain; a welding current which can be reduced to as low as 25 amperes for light work and thin gauge metals—these are some of the features that make the Wilson Type S a distinct achievement in electric arc welding. Write today for complete information and prices.

If any weld must be perfect—it is the weld below the water line of a ship. Under all conditions, in spite of all kinds of pressure, stress or strain, it must hold. For once the ship is at sea, such repairs are practically impossible.

At the Fletcher Shipyard, Hoboken, N. J., they were welding a huge, steel contra-propeller to a rudder post—welding not only below the water line, but in a most vital part of the ship. And for this weld which had to *hold*—for this weld which had to be *perfect*—Wilson Wire was used.

It is significant that in welding of this kind, welding in which no chance can be taken, welding that must be impervious to the greatest strain, stress and pressure—Wilson Wire is chosen. It is because men who have had experience with Wilson Wire know they can select the correct grade (analysis) for the kind of metal they're welding—and that *every rod will be like every other rod* in the grade selected. This means practically perfect welding jobs.

Write today for your samples of Wilson "Color-tipt" Welding Wire, indicating the kind of metal you desire to weld.

WILSON WELDER & METALS CO., INC., WILSON BUILDING, HOBOKEN, N. J.

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WELDING MACHINES AND WELDING WIRE

Select the Wilson Welding Machine that Meets Your Own Operating Conditions

Wilson Type S Single-Operator Motor-Driven Electric Welding Machine. Designed for both production and repair work. Adapted for use wherever power is available. Capacity, 25 to 250 amperes.

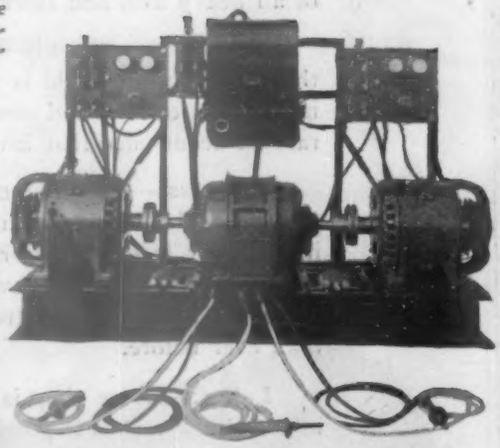
Wilson Type S Single-Operator Belt-Driven Electric Welding Machine. Belt-driven from line or counter shaft or for direct connection to gasoline engine. Capacity, 25 to 250 amperes.

Wilson Type S Single-Operator Gasoline-Engine-Driven Electric Welding Machine. A complete, self-contained unit—may be easily moved and operated anywhere. Capacity, 25 to 200 amperes.

Wilson Type S Single-Operator Gasoline-Engine-Driven Electric Welding Machine, heavy duty type. Capacity, 25 to 250 amperes.

Type S Features

Every Wilson Type S machine has a simple, compact control panel; a *self-exciting* generator; an arc that is easy to strike and easy to maintain; a current adjustment by a simple turning of a field rheostat knob; a commutator that always shows *less temperature rise than any other part of the machine.* The welding current can be reduced to as low as 25 amperes for welding thin-gauge metals.



Wilson Type S Two-Operator Stationery Motor-Driven Electric Welding Machine, heavy duty type. Capacity, 25 to 500 amperes.

With its simple construction, close regulation, rugged strength—*superior engineering throughout*—the Wilson Type S has proved itself a *better welding machine.* Its features—many of which are found in no other machine—make the Wilson Type S the choice for practically every kind of welding. And you can select the Wilson welding machine that meets your own operating conditions. Read descriptions above, and write today for full information and prices.

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for the

Repair of Medium and Heavy Sections

in all

Fields of Repair Work

Adaptability:—The Thermit Process lends itself to the repair of all medium and heavy sections, which means that it is available for the repair of all heavy iron and steel parts and many smaller parts.

Reliability:—Twenty-one years of practical use have shown beyond doubt that the Thermit Weld is the strongest and most durable method of effecting repairs to iron and steel sections. The failure of a Thermit Weld is so rare an occurrence that it can invariably be traced to an outside cause.

Progress:—The Thermit Process has not stood still. New and improved methods have been and are constantly being developed. Thermit itself today is far superior to the product of only a few years ago. The methods of applying it have been simplified with the results that the welds are not only better and stronger but can be made quicker and more cheaply than ever before.

Labor:—Every shop is anxious to increase the output of its force. Thermit Welding makes it possible to use labor economically and efficiently—the man-hours of labor on a Thermit Weld are lower than on any other method, and the cost of the finished weld correspondingly lower—the output higher.

Economy:—The Thermit Weld means the permanent rehabilitation of the piece to be repaired at a cost which compares favorably with any other method—and at a tremendous saving over the cost of a new part.

Proof:—The demand for Thermit in the U. S. and Canada has increased each year and our list of customers grows continuously. Wherever comparative tests have been made the Thermit Process has overwhelmingly proved its superiority over all other methods for welding heavy sections. We shall be glad to demonstrate this to your own satisfaction if you wish.

Send for Pamphlet No. 1879

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For work where only the highest quality of welding is acceptable, welding wire of Roebling quality is specified.

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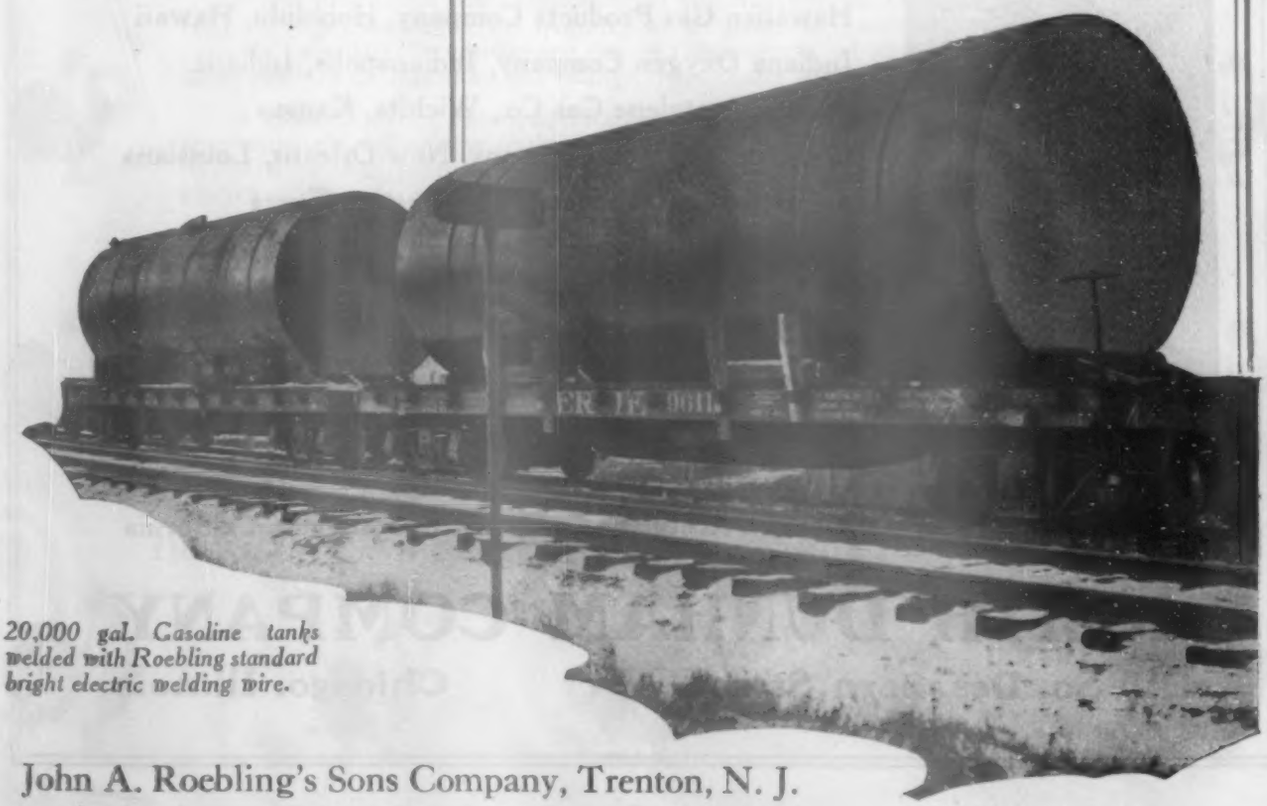
Roebling Welding Wires conform to all standard specifications in every detail.

They produce sound welds.



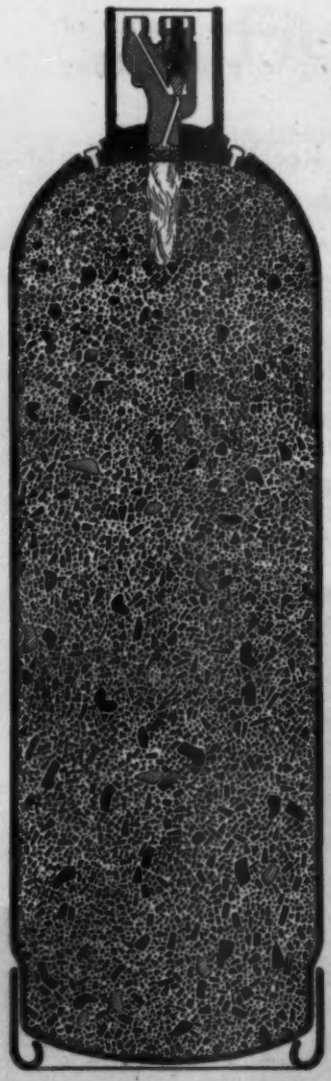
20,000 gal. Gasoline tanks welded with Roebling standard bright electric welding wire.

John A. Roebling's Sons Company, Trenton, N. J.

MONOLITHIC FILLED ACETYLENE CYLINDERS

We have consistently advocated the use of monolithic filler in acetylene cylinders. We know that this type filler cannot deteriorate or sag and that it will perform its safety function throughout the life of the steel shell of the cylinder itself.

We know also that acetone losses are reduced to a positive minimum by proper monolithic filler which actually holds the solvent in suspension. This cuts down the expense of reacetoning cylinders, which is an important item in any acetylene plant.



The confidence of the industry in acetylene cylinders manufactured by us is best indicated by the growing list of companies using them.

Acetylene Gas & Supply Co., Toledo, Ohio
Acetylene Products Company, El Paso, Texas
Acetylene Products Company, Phoenix, Arizona
Acme Oxy-Acetylene Company, Chicago, Illinois
Compressed Acetylene Company, Louisville, Kentucky
Compressed Gas Corporation, Los Angeles, Oakland, Seattle
Gas Products Company, Columbus, Ohio
Grand Rapids Welding & Supply Co., Grand Rapids, Mich.
Hawaiian Gas Products Company, Honolulu, Hawaii
Indiana Oxygen Company, Indianapolis, Indiana
Kansas Acetylene Gas Co., Wichita, Kansas
Louisiana Oxygen Company, New Orleans, Louisiana
Magnolia Gas Products Co., Houston, Texas
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Midwest Oxygen Company, Portsmouth, Ohio
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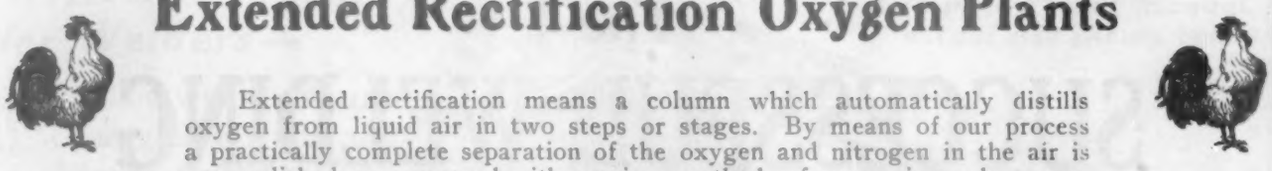
KEITH DUNHAM COMPANY

110 So. Dearborn Street **Chicago. Illinois**

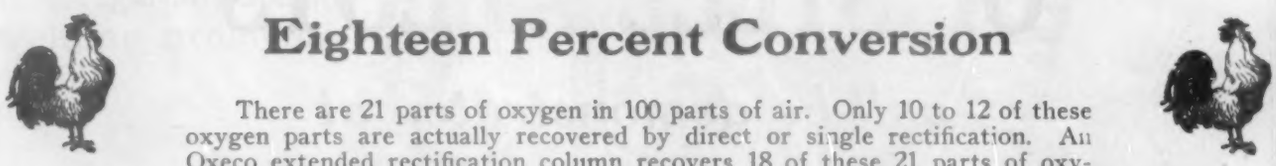
OXECO

Extended Rectification Oxygen Plants



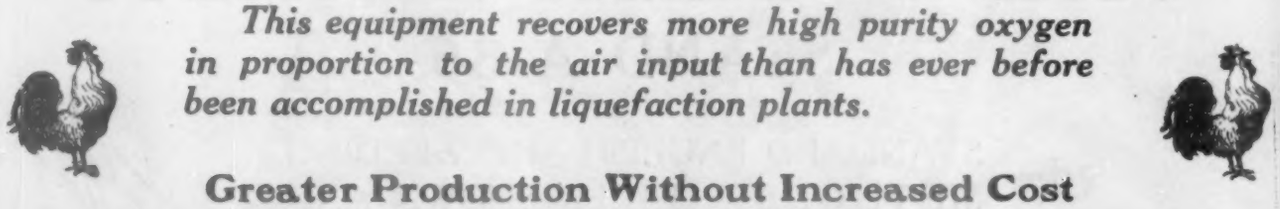
Extended rectification means a column which automatically distills oxygen from liquid air in two steps or stages. By means of our process a practically complete separation of the oxygen and nitrogen in the air is accomplished, as compared with previous methods of recovering only a comparatively small amount of the oxygen and wasting the rest with the outgoing impure nitrogen.

Eighteen Percent Conversion



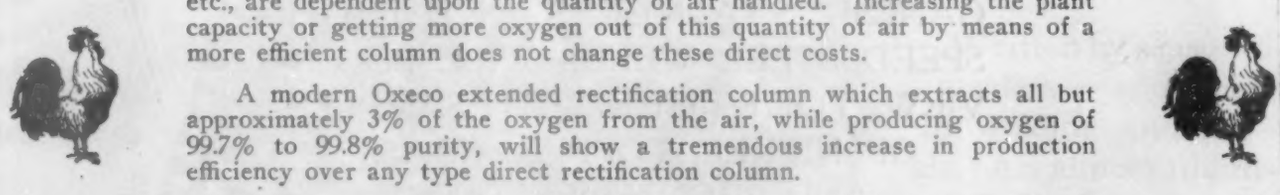
There are 21 parts of oxygen in 100 parts of air. Only 10 to 12 of these oxygen parts are actually recovered by direct or single rectification. An Oxeco extended rectification column recovers 18 of these 21 parts of oxygen. This is proved by the fact that our modern columns will produce 99.7% to 99.8% oxygen and 97% to 98% nitrogen simultaneously.

This equipment recovers more high purity oxygen in proportion to the air input than has ever before been accomplished in liquefaction plants.



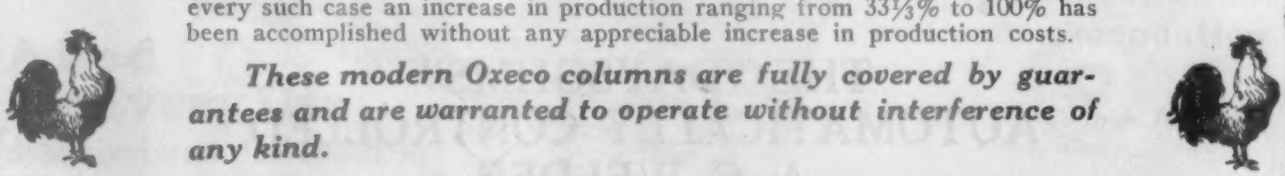
Greater Production Without Increased Cost

Direct production costs consisting of power, labor, oil, chemicals, water, etc., are dependent upon the quantity of air handled. Increasing the plant capacity or getting more oxygen out of this quantity of air by means of a more efficient column does not change these direct costs.



A modern Oxeco extended rectification column which extracts all but approximately 3% of the oxygen from the air, while producing oxygen of 99.7% to 99.8% purity, will show a tremendous increase in production efficiency over any type direct rectification column.

Many oxygen producing companies have already substituted extended rectification columns for the older type direct rectification columns. In every such case an increase in production ranging from 33⅓% to 100% has been accomplished without any appreciable increase in production costs.



These modern Oxeco columns are fully covered by guarantees and are warranted to operate without interference of any kind.

KEITH DUNHAM COMPANY

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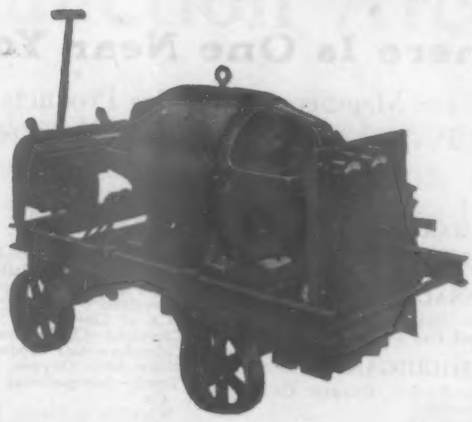

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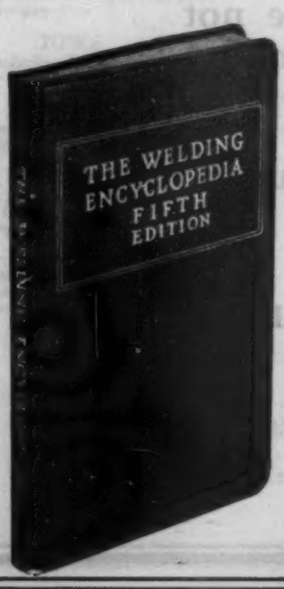

It describes in detail the theory and practice of every welding process. It tells how to weld every weldable metal by each of the welding processes. It gives detailed instructions for handling the important welding jobs, such as boiler welding, sheet metal welding, tank welding, pipe welding, etc. It tells how to prepare parts for welding. It tells how to install and care for welding equipment. It explains the meaning of all words and terms found in welding literature. It tells where to buy all standard makes of welding apparatus and supplies.

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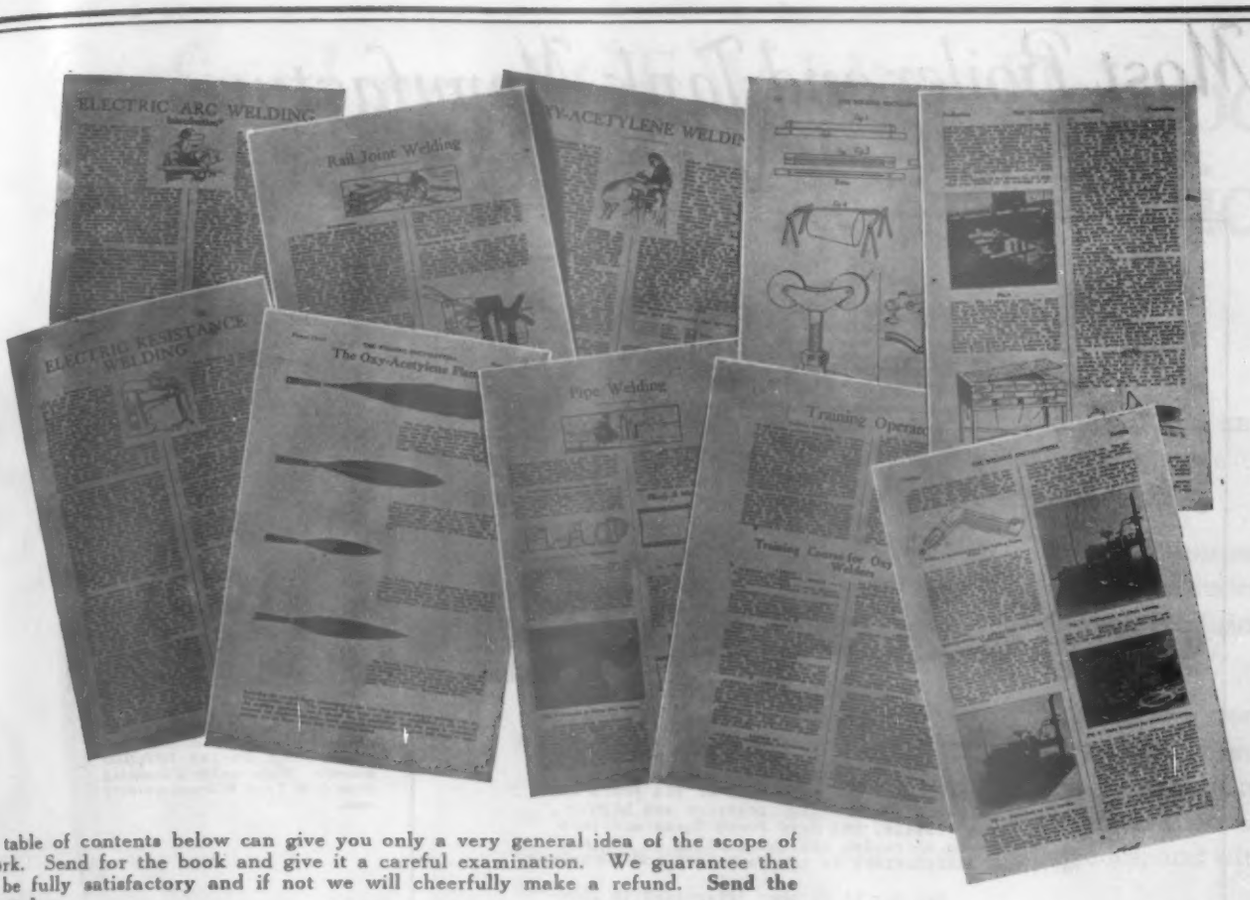

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3. Electric Arc Welding.—Complete instructions for welding all metals, studding, cutting, etc.
4. Electric Resistance Welding.—Includes Butt Welding, Line Welding, Percussion Welding and Spot Welding.
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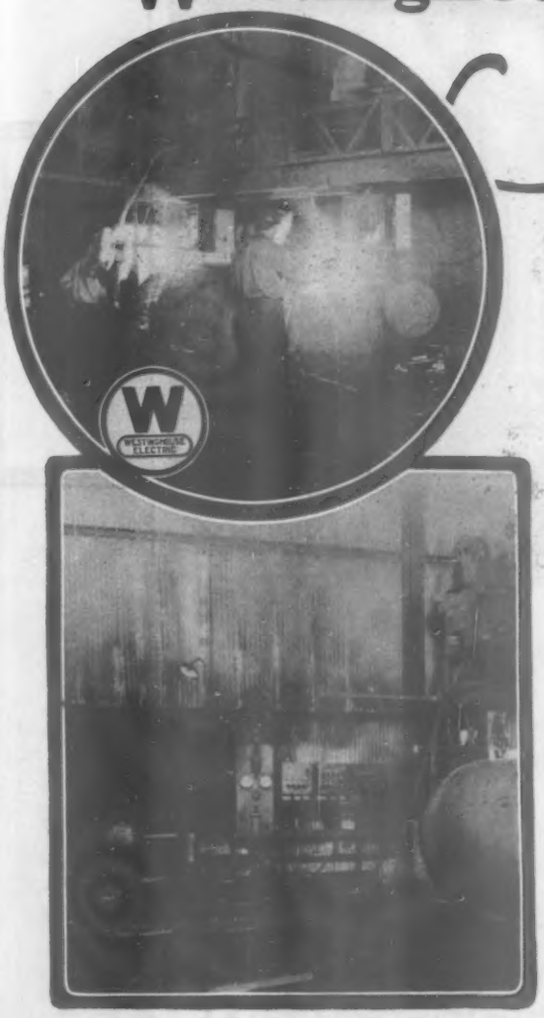

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See letter below

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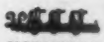
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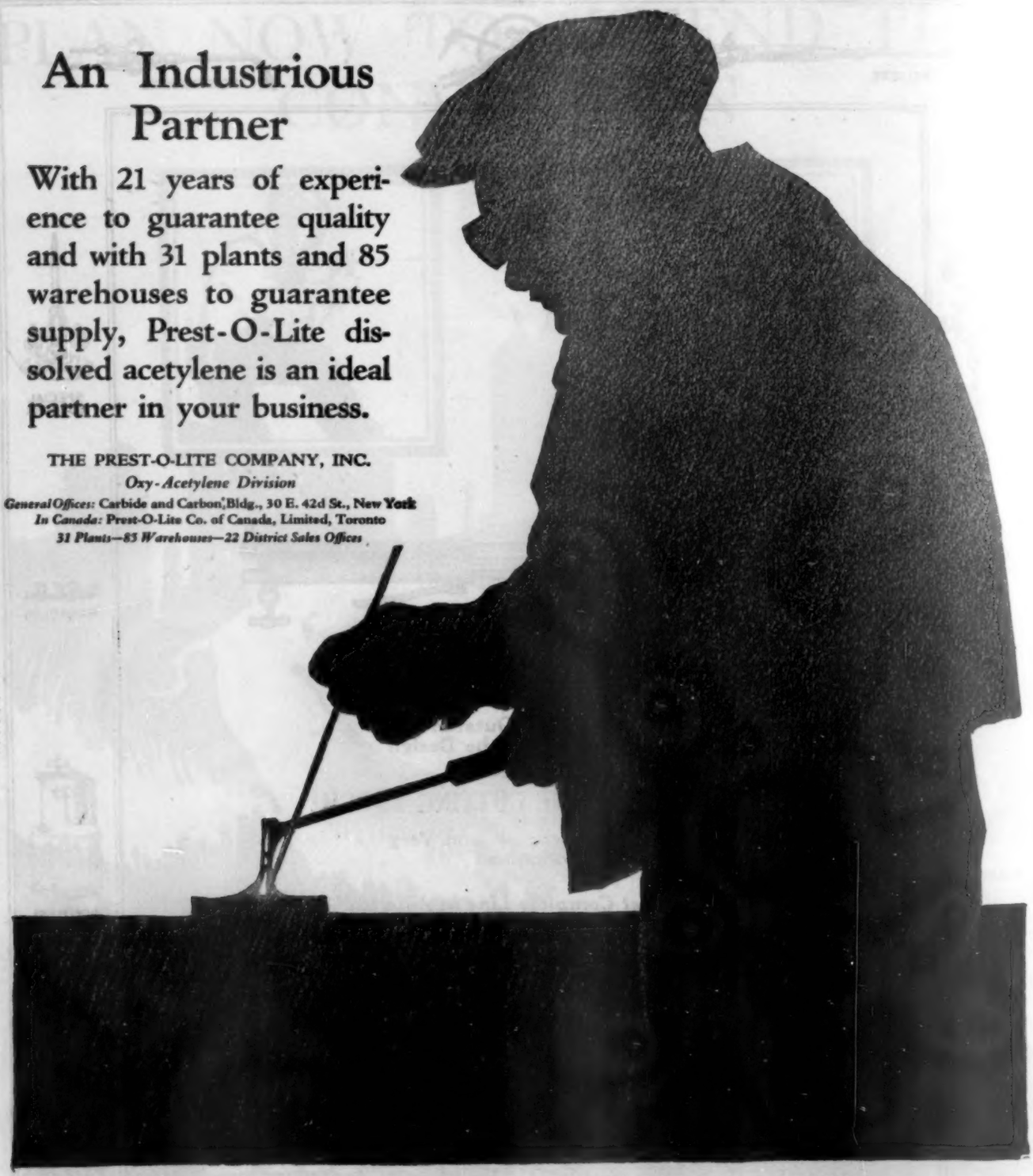

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EDITORIAL

Critics Fail to Look at All Facts

IT certainly does not seem fair to judge welding processes by the statements of an inspector who claims in a letter to a technical paper, that there are plenty of so-called responsible manufacturers who have turned out, and are turning out, pressure vessels that are a menace to human life, and that failures of welded air tanks are invariably due to weaknesses produced by welding. Even though such a theory is supported by a lot of experience this does not prove that welding cannot produce joints that are strong and dependable for a number of different types of buildings and steel structures. One writer points out that the welding operation changes the structure of the parent metal in the vicinity of the weld and that this change in structure can only be overcome by annealing, then raises the question "How are you going to anneal a sky-scraper?" As a matter of fact a sky-scraper does not seem to be a logical starting point of the application of welding to structural steel. This development of the industry will be a long process. But when we do reach the point where we can design welded joints for sky-scrapers which are as strong as they need to be and stronger than the present riveted joints, we see no reason for trying to find ways and means to anneal the building.

Need for Pure Research

AN investigation of the amount of attention given to the subject of fusion welding in the average engineering course will undoubtedly suggest the desirability of working out some sort of a standard program of instruction, which would give the graduate engineer sufficient knowledge of the merits and limitations of welding so that he would know where and when to use it, and a close enough acquaintance with the fundamental principles involved, so that he would be able to exercise intelligent supervision over welding operations. But once let the research facilities of our universities be directed on subjects of fundamental importance in welding and then these institutions are apt to produce results of far greater significance. The apparently aimless character of the investigations carried on by the pure scientist has a definite value in that there is no search for a preconceived result. His findings are often subjected to the brilliant interpretation of some commercial genius who has the happy faculty of turning fourth-dimensional phrases into dollar signs. And the public says, "How the world do move!" Two professors in one of our large universities have been making a study of the metallic arc, and a part of their work has been reported for publication. The interesting feature of their report is that it does not solve, or even attempt to solve, any of the great problems before the welding industry. It seems rather to investigate the nature of the metallic arc in a curious, inquisitive way. No prediction can be made of the ultimate value of such a study, because there is no way of telling where it will end. Perhaps the physical-chemist can work backward from the results to determine what must have taken place to produce them, and thus turn up some important information regarding the action of the arc, which has heretofore been unknown. This is only one of several possibilities of good that may come from a single investigation. Other investigators in the field of metallurgy are publishing reports from which simple solutions of extremely important welding problems may possibly be derived, although no special thought of welding was in their minds. There are many examples of pure research developing by the merest accident into valuable commercial channels. The industry should appreciate and encourage this type of research.

Overhead Welding

TO the average layman, overhead welding looks like a very doubtful bit of procedure. Making metal flow uphill doesn't sound good to him. Then he sees a good welding engineer trying to avoid it and his impression is strengthened until he finds out that horizontal welding is recommended because it is faster and easier on the operator. A street car motorman will tell you that he is less afraid of accidents on a rainy day than on a clear dry day—because everybody knows the going is dangerous and is careful. For the same reason, overhead welding is apt to average better quality than flat work. One experienced oxy-acetylene engineer recently told of a test on pipe work, where the overhead work proved to be the best in quality. The question was put to an arc welding engineer a few days later and he said, "When a welder is working on an overhead job, he's got to get a good job or he'll get it in his shoes." It is difficult welding, but the difficulties operate to secure the kind of painstaking effort that produces fine work as a rule.

Editorial Views of Welding

MEN who have been giving their time and energy to the development of welding are getting a part of their reward in the splendid compliments which welding has lately been receiving in the technical press. Editorials of some of the leading industrial papers show that welding is making a stronger impression than ever in practically all of the major industries. It is interesting to observe that current editorials, while recognizing the virtues of welding, do not hesitate to point some of the duties ahead of its promotors. One editor speaks of welding as being one of the established fundamentals with applications as broad as industry itself and deserving of a place in the curriculum of engineering schools. He also points out that the engineer, after graduation, must be able to design for welding in order to use the process to advantage, and urges effective methods of teaching young engineers to make such designs. Another editor comments on the success of recent tests of welded steel structures and promises that we shall hear more of the employment of oxy-acetylene or electric welding in the construction of buildings and bridges. This editor also points out the resistance that is to be expected from structural men, because engineers and designers have not been educated to the use of modern welding methods and will require abundant demonstration of their efficiency. There is some good advice in this editorial on the subject of making progress with extreme caution, keeping all work under close control of competent engineers so that there will be no failures to handicap the promising program of success. In a third editorial that has recently appeared on the subject, a more extensive use of welding is urged. Particular emphasis is laid here on the consideration of reduced cost not only in actual labor of assembly but in the saving in material and better service which can be obtained in many cases with welded joints. "Some engineers and some plants are waking to the advantages that can be derived from welding and are rapidly widening their use of this method," remarks this editor, "the results that they achieve can not fail to be a strong inducement to the more conservative brethren to follow suit." These current comments show a better understanding of the merits of the welding process and of the future of the welding industry than has ever been shown before. The educational work of prominent manufacturers in the welding industry and of the trade press in this industry is beginning to bear fruit enough to encourage continued work in this direction.

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When welding was first introduced into this country, Linde realized that ultimately thousands of men must be trained in welding technique.

As industry after industry adopted this new technique, many engineering problems had to be solved and Linde service was necessarily expanded to include engineers who combined an expert knowledge of welding with wide engineering experience.

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LINDE OXYGEN

Arc Welding Stainless Steels

One Firm Makes a Specialty of Fabricating Chromium Irons and Stainless Steels Into Containers and Other Products

By W. C. Johnson

THE scene of man's battle against corrosion is shifting to America. Today our steel mills are producing more high chromium iron per month than England produced per year following its discovery, in that country, 14 years ago. More than five large mills are making chromium iron or stainless steels, as they are often called, in the form of bars, sheets and plates. American industry is just beginning to realize the many advantages these rustless irons have over ordinary steel, or copper and its alloys with nickel. For instance, a solution of nitric acid, that would completely destroy a 20 penny nail in about an hour, has no appreciable effect on rustless iron, having a chromium content of over 18 per cent.

Since the present price of this material is many times that of mild steel, the fabricator must reduce the weight of his finished product to a minimum and also use that method of joining the metal together that will result in the lowest labor costs.

The Industrial Welded Products Company, over a long period of experimentation and research, has developed the electric welding of these chromium irons to a high point of perfection. It is now possible to make welds in a high chromium, low carbon plate, that have the same chemical analysis as the plate itself. Under physical tests the ultimate strength of these joints invariably exceeds the elastic limit of the plate, and by subsequent heat treating, their tensile strength can be increased to over 70,000 lbs.

W. C. JOHNSON

Mr. Johnson, who is vice-president and general manager of the Industrial Welded Products Company, Newark, N. J., specialists in the production welding of chrome irons and stainless steels, is a graduate of Sheffield Scientific School of Yale University. He spent five years in the plant of the M. W. Kellogg Company, making an intensive study of gas, arc, and hammer welding, and for the past three years has been active in his present connection, specializing in the electric welding of alloys.

Microphotographs of chrome iron welds, made with the electric arc, show clearly the very close grain obtained in the deposited electrode, or the weld itself. Figure 1 shows a piece of stainless steel plate itself, in which the chromium content runs up to 25 per cent. Figure 2 is the weld itself, made in the same plate, so that it also has a chromium content of 25 per cent and Figure 3 illustrates the juncture of the plate and weld, showing that the grain growth at this point, has been held to a minimum.

The element of chromium combined in the right proportion, with carbon and silicon, makes these welds as resistant to corrosion and oxidation as the chrome iron plates they join together. This is one reason why we use the electric arc, since it does not burn away any part of the chromium content in the rod, nor increase the carbon content. Furthermore, since molten chromium has a great affinity for oxygen and with it will form infusible chromium oxides, it is desirable to melt the electrode very rapidly, so as to lessen the forming of such oxides. Since the arc is so fast and will not bring a large area about the weld to a melting temperature, we believe, it has a marked advantage for this particular class of welding.

Those of us who work with metals have read, with interest, about the lead pipe of the Romans, which has withstood the attack of corrosion for centuries. It is now possible to make thin wall steel pipe from these chromium alloys, by forming and welding sheets into tubular form, which will resist the corrosive action of the elements for centuries to come.

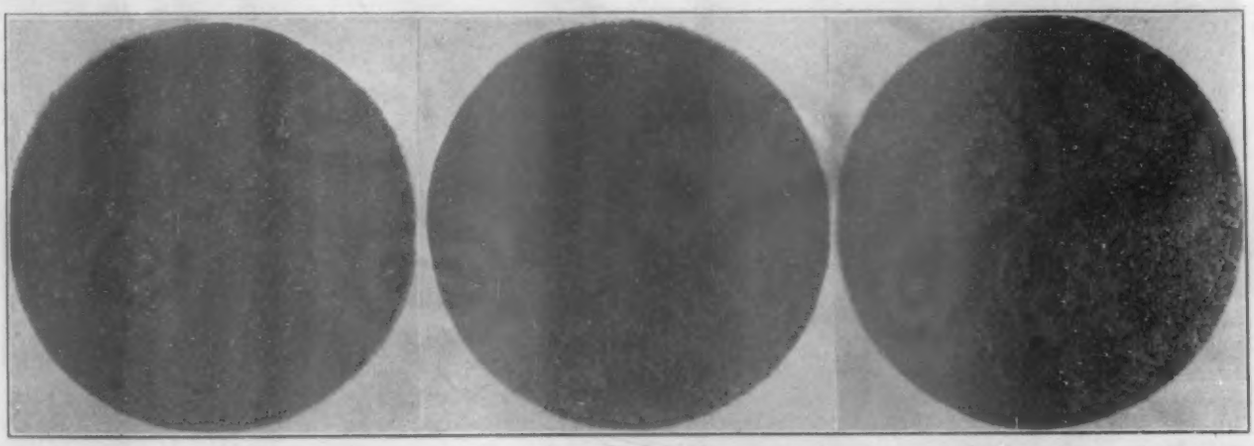


Fig 1. Structure of Stainless Steel. Fig. 2. Structure of Weld Metal. Fig. 3. Juncture of Plate and Weld.

Figures 4 and 5 show a complete line of welded chrome iron pipe, together with elbows, tees and crosses, made entirely from 14 gauge sheets.

In the chemical industry, where nitric acid, in dilute form, plays such an important part in the manufacture of some of our daily needs, such as imitation silk, paint, body polishes, imitation leather and celluloid products, chrome iron welded containers, such as tanks, digestors, separators, pipe, etc.,

have great economic use. The ability of this alloy to resist nitric acid, in all concentrations, makes it superior to any alloy previously used in our large nitration plants. Figure 6 illustrates an all welded absorbtion tower, having a chromium content of 25 per cent, as used in the plant of an internationally known manufacturer of paints. Figure 7 shows an all welded separator, made from 18 per cent chromium

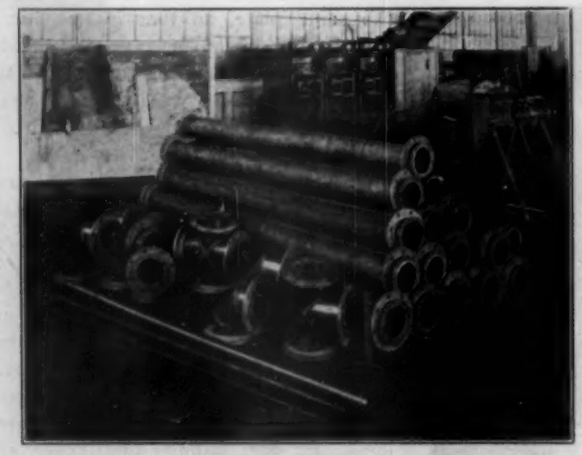


Fig. 4. Six-Inch Ascoloy, No. 1, Pipe and Fittings.

iron sheets. This metal container enables the manufacturer to recover a large amount of nitric acid, previously wasted, in exhaust fumes. The vital part of this separator is an all welded helix, or defector, inside the unit, which could only be made from sheet metal by the successful application of welding.

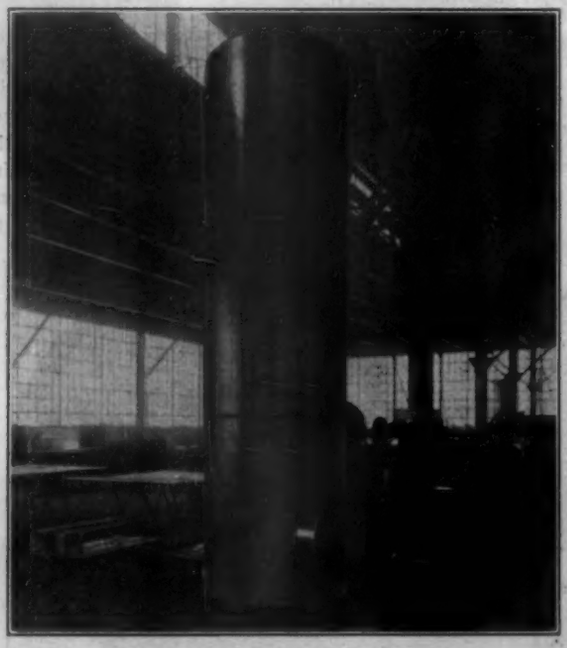


Fig. 6. 4-Foot by 18-Foot Ascoloy, No. 1, Absorption Tower.

Stills and digestors made from these chromium bearing plates are often subjected to radical temperature changes, a condition that gives trouble with riveted joints, in that they must be often re-caulked. This is where a welded joint should be used in place of one made up with rivets. Figure 8 shows such a still, with a standard flanged and dished head, made entirely from 18 per cent chrome iron plates. This unit is operating daily in a chemical plant, with a direct flame heating the bottom to a temperature of about 1300° F.

In place of copper kettles, that had to be silver plated inside, one large manufacturer of moving picture films, is using stainless steel kettles, on which the welds had to be perfect and also polished to match the surface of the highly polished sheet, as shown in Figure 9.

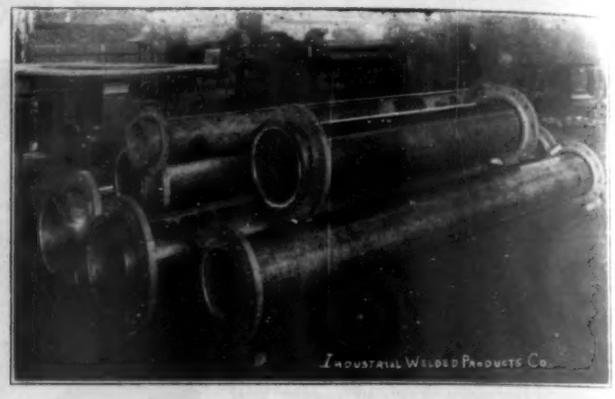


Fig. 5. 10-Inch and 12-Inch Duraloy Pipe.

Figure 10 illustrates how easily a rather intricately shaped exhaust fan box, may be made from these 18 per cent chrome iron sheets. Consider the number of rivets and extra angle irons that would be required to form this unit without the use of welded joints.

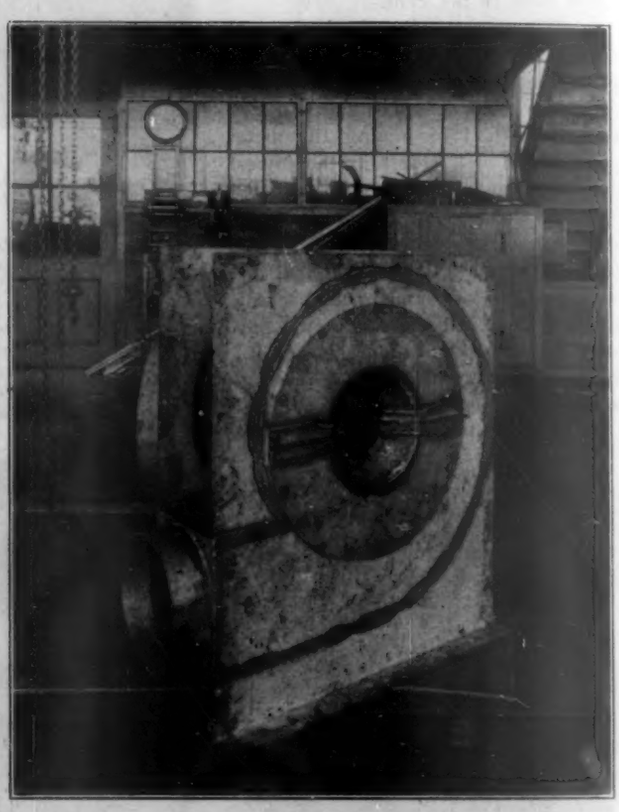


Fig. 10. Delhi Fan Box.

Another surprising feature of these chrome iron alloys is their ability to resist oxidation at temperatures ranging from 1600° F. to 2300° F. Figure 11 illustrates three types of heat treating containers, all of which are welded by this process. These welds are just as resistant to oxidation as the plates they join together and will also withstand the excessive strains of contraction and expansion, caused by the repeated heating

and cooling of the containers, when held for many hours, at high temperatures, in heat treating furnaces.

Another illustration of the use of chrome iron to resist oxidation is shown in the large all welded annealing hood, in Figure 12. This hood is used to protect coils of cold rolled steel, from the air, while they are held at annealing temperatures. In spite of the large areas of plates exposed to direct flame temperatures, these welds are giving perfect service, since they are capable of holding the expansion and contraction strains set up in the plate.

One of our rather difficult welding jobs is shown in Figure 16. This is a nickle-chromium plate, known as nichrome, manufactured by the Driver-Harris Company, of Harrison, N. J. In these large plates the nickel content is 62 per cent, with a chromium content of 13 per cent, the balance being iron. Since this alloy is extremely expensive, in this case costing a dollar a pound, we formed the large plates by arc welding small narrow plates together to form one piece. The large plates were used by a glass manufacturer as baffle plates in a furnace. They had to be absolutely flat and free from buckles.

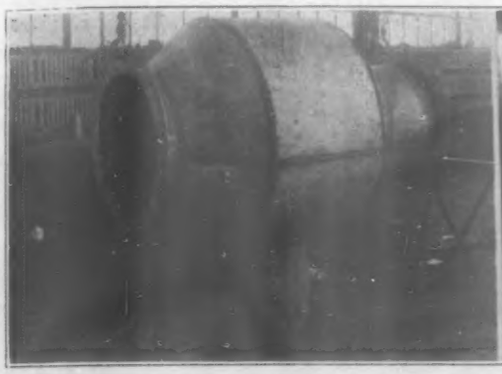


Fig. 7. 24-Inch Delhi Separator.

Fig. 8. Enduro Still.

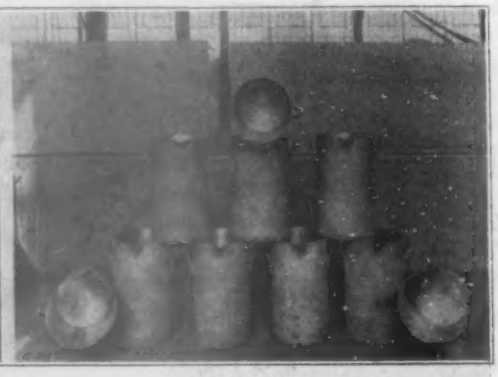


Fig. 9. Delhi Kettles.

Fig. 11. Unilloy and Delhi Carbonizing Boxes.

Fig. 12. 44-Inch by 48-Inch Delhi Annealing Hood.

In order to resist certain flame gases it is frequently advisable to use alloys of chromium with nickel. Figure 13 shows three furnace linings, comprised of nickel chromium castings, with the same analysis of sheet welded to the cast bottoms and also welded to the cast re-enforcing ribs.

A rather novel use, made possible by welding, is the covering of industrial rolls, that are subjected to corrosion, with protective sheets of these stainless steel alloys. Figure 14 illustrates a textile roll, veneered with a sheet of 18 per cent chrome iron. This process involves the shrinking and welding of the roll shell around the surface of the cast iron roll. After these rolls are covered, the weld itself is ground flush with the sheet surface, which must present a perfect finish free from all porosity. We recently covered a large brest roll, for a paper mill, which had a diameter of 22 inches and an over-all length of 17 ft. This large roll cover had one continuous straight weld and several circular welds, all of which we ground smooth in a centerless grinder, giving the roll the appearance of a large stainless steel seamless tube.

Figure 15 is a photograph of five 6-inch carbonizing tubes made from 18 per cent chrome iron plate, having a wall thickness of $\frac{1}{8}$ inch. We have had tubes, similar to these, in use now for over a year in a carbonizing process, where the temperature to which the tubes are heated runs up to 1650° F. The welds are as strong today as they were a year ago, and we have reason to believe that these tubes will continue to render service for at least two more years.

Fig. 13. Nichrome Heat Treating Furnaces.

And now a few words in conclusion. In my daily work of selling welded chrome iron or stainless steel containers, I sometimes meet engineers and plant managers, who do not believe that these various alloys can be successfully welded.

They may have tried it in their own plants or welding shops and because they did not succeed in the first attempt they say that it can not be done. When we first started we were inclined to believe they were right, but after many months of

Fig. 14. 9-Inch Cast Iron Roll Covered with Enduro.

experimentation, we developed a method that is successful and is now delivering the goods. These alloys of chromium are not in the same class with ordinary steel. They require their own welding methods, which are simply refinements of present welding practice, calling for a combination of correct design for the job, the right welding machine, a specially prepared welding wire and rigid inspection, followed by subsequent testing of all work before shipment. I trust that this story and these photographs, all of which represent successful welding jobs, in six different makes of chromium alloys, will help to convince those who doubt that it can be done. I also wish to express my appreciation for the help we received from the Wilson Welder and Metals Co., who developed a welding machine to meet our requirements and gave us access to their welding laboratory, when we first started to develop the process for welding these chromium alloys with the electric arc.

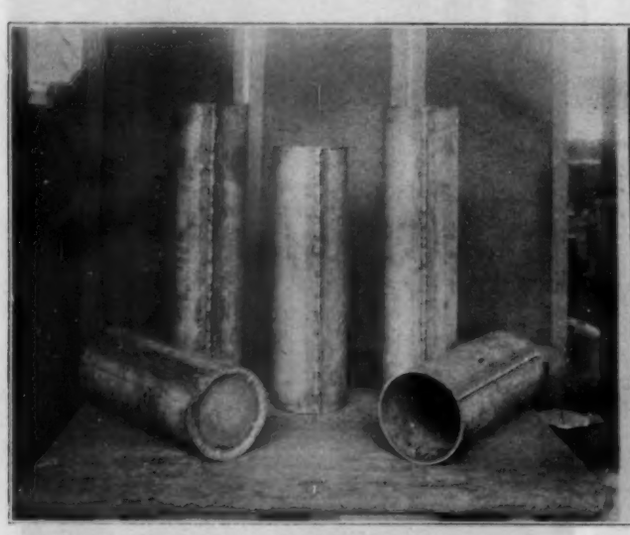


Fig. 15. Six-Inch I. D. Enduro Carbonizing Tubes.

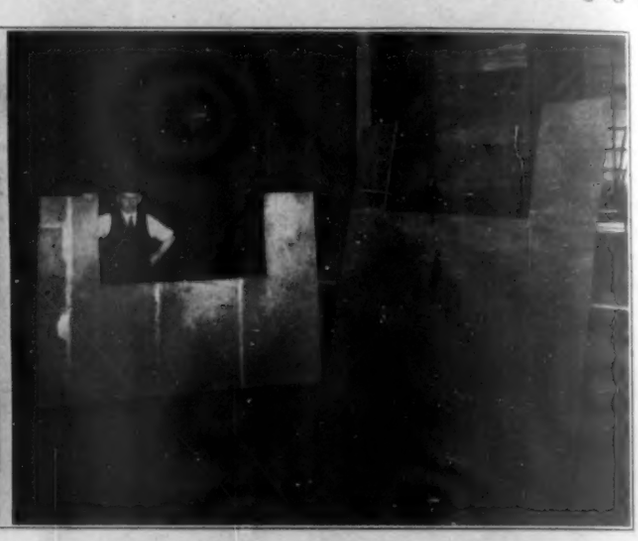


Fig. 16. ¼-Inch and ⅜-Inch Plate Developed by Welding Small Sections Together.

MOTOR METER OFFICIALS ACQUIRE CONTROL OF NATIONAL GAUGE AND EQUIPMENT COMPANY

Announcement has been received that the controlling interest of the National Gauge and Equipment Company, LaCrosse, Wis., has been acquired by G. P. Townsend, president of the New York branch of the Motor Meter Company, and that plans are under way to construct an addition so that the output of automotive gauges and other equipment may be increased. The plans call for a new building 150x155 feet, which will mean an increase in working space of approximately 50 per cent. The officials of the company expect that the completion of the new plant at the end of this year will relieve the Long Island City plant of the Motor Meter Works of considerable work in the manufacture of heat recording devices. The manufacture of gauges for welding and cutting apparatus in the LaCrosse plant will continue as before with no change in the policy or personnel as a result of the new ownership.

ENGLISH FIRM TO EXHIBIT AT BUFFALO

Announcement has been received that Alloy Welding Processes, Ltd., of London, England, will have a booth at the International Welding and Cutting Exposition, to be held next month in connection with the annual fall meetig of the American Welding Society. This firm has developed an extensive line of special filler rods and will be prepared to demonstrate new methods of welding high carbon steel, manganese steel, stainless steel and high speed steel. Samples of welds made on nickel, brass and bronze will be exhibited. This company makes an alternating current welding machine called the "Daysohms," a special feature of which is automatic control. One of these machines will be operated at the exhibit. Alloy Welding Processes will be represented at the Buffalo meeting by Mr. E. H. Jones, who is managing director, and Mr. A. J. Hoare of the engineering staff. "The methods in use in England are essentially different from methods in use in the United States," says Mr. Jones, "and we feel in consequence that our exhibit is likely to attract a considerable amount of attention."

NEW INDUCTION ARC WELDER

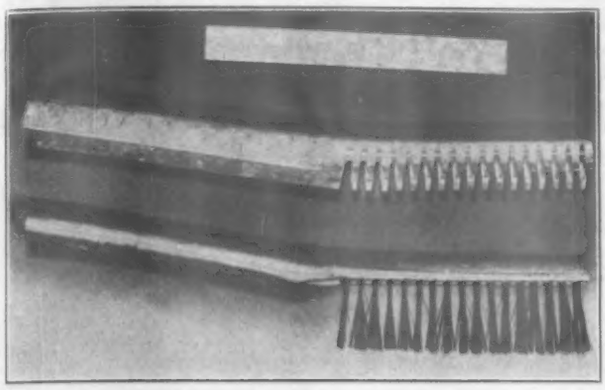
The Owen Electric Manufacturing Company, Fayetteville, North Carolina, announces a line of 37 different types of A. C. welding machines with a current range from 25 amperes up. The Owen A. C. welder is of the induction type and specific claims are made for it for deep penetration and high production on overhead and vertical welding as well as flat welding. Officials of the company state that the machines will be marketed as far as possible through distributors and its present program is the appointment of reliable distributors in the important territories as fast as possible.

THE UNA DYNAMOTOR

Its wide range of work is one of the particular features emphasized by the Una Welding and Bonding Company, Cleveland, Ohio, in the recommendation of their Type A dynamotor for commercial welding. This machine operates from alternating circuits for direct current welding with a capacity from 75 to 450 amperes. Since it can be used for either carbon arc or metallic arc welding it can be applied to either the welding of very thin sections or to heavy work as filling in blow holes in the largest castings. It is supplied either with a stationary mounting or truck mounting.

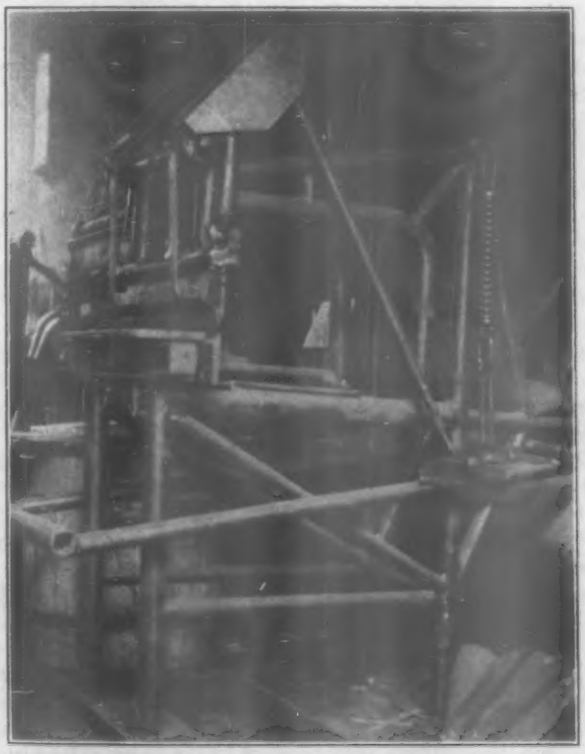
WELDERS' BRUSHES MADE IN ALL WELDED FACTORY

For several years Mr. C. Sorensen, 18 E. 16th St., Chicago, has been engaged in the manufacturing of all steel wire brushes for use in garages, machine shops, welding shops, etc., and has been advertising them particularly to the welding trade because of their ability to stand up under the hard



Brushes Made by Welded Machinery.

usage of high temperatures. Mr. Sorensen has been very well acquainted with the welding trade for a number of years as he is the inventor and maker of a metal handle for holding welding rods for oxy-acetylene welding. The line of wire brushes which he makes is a more recent development.



Note the Number of Welded Joints in this Shear.

This manufacturing business has been developed in what was originally a job welding shop located years ago in what was then the heart of the automobile district. The automobile business was concentrated in a fairly limited area and there were not many welders who were able to handle a complete line of automobile welding repairs. The welding end of his business has naturally decreased in importance with the spreading out of the automobile business and the establishment of a great many job welding shops in all sections of Chicago. His work is so well known, however, to many of the old timers in the Michigan Avenue district that he continues to do a desirable amount of repair work.

The greater portion of Mr. Sorensen's shop is devoted now to the manufacture of all steel wire brushes which are made in four sizes. One straight brush, small size is made particularly for men engaged in soldering. Mechanic's brushes of the shape shown in the illustration are made in three sizes for different grades of work. The product itself is worthy of comment on account of the careful selection of materials which are put into it, and the sturdy construction which insures that the brush will hold together until the

This Machine Assembles the Brushes. It Is All Welded.

wire bristles are entirely worn out. When used in smoothing metal at the finish of a weld or when laid on top of hot metal, they are not damaged by the high temperatures because nothing except metal is used in their construction. It would be difficult to enumerate all of the uses a brush of this kind can be put in a garage, machine shop or welding shop.

The production process is a fairly simple one and is suggested by the photograph of the assembly. The handle and back of the brush are formed from a single piece of galvanized sheet steel. The bristles are fed to the holding spaces by machine. The small strip of galvanized steel shown in the photograph is laid over them, then two press operations squeeze them together to form a finished brush, ready for action.

There is one outstanding feature of this shop which will be of interest to every welder who gives any thought to the possibility of doing things with the torch. Several photographs of the machinery are reproduced here and a casual glance will tell the reader that there has been some welding done in this machinery. A more careful inspection of the photographs will show that practically every joint in this equipment is a welded joint. The fact is that Mr. Sorensen has constructed all of this machinery himself using discarded pieces of machinery, cutting them to shape with a cutting torch, bending them where necessary and assembling them into usable equipment by welding all joints.

A second inspection will show that practically all of the parts contained in this shop equipment can be purchased at scrap metal prices from any junk dealer.

All This Machinery Was Made from Scrap.

I-Beams, Angles, Steel Pipes, Drive Shafts, Levers, Automobile Crank Shafts, Gears, Pulleys, Plates and Bars have all been utilized in the construction of shears, dies, forming presses and machinery for feeding bristles to the brushes. Mr. Sorensen says that he can turn out as many as five hundred brushes per day with his present equipment, but that he could not possibly have put in such equipment without the oxy-acetylene welding torch because of the high cost of having such machinery built to order. The combination of patience, ingenuity and welding has enabled him to start a manufacturing business which without this combination would have required considerable capital.

The fabrication of an entire factory equipment by means of the oxy-acetylene torch is an unusual application. In this case the advantages are so marked as to bear out the statement which is often made that there are no limits to the possibilities of saving money through the intelligent use of welding.

NEW TESTING LABORATORY IN CINCINNATI

Announcement is made of the formation of Robert J. Anderson, Inc., to operate as a commercial testing laboratory, specializing in metals and alloys.

The new laboratory, which is situated at 2416-38 Beekman St., Cincinnati, Ohio, is fully equipped for chemical analysis, mechanical testing, metallograph, heat treatment, and radiography.

The laboratory is staffed with a corps of qualified chemists and metallurgists under direction of Dr. Robert J. Anderson, the well-known metallurgical engineer and expert on aluminum.

Officers of the company are: Dr. Robert J. Anderson, president; H. J. Hater, treasurer; and R. T. Mesker, secretary. These with John Eckerle and E. F. Eckerle form the incorporators and directors. Further details will be announced later.

INTERNATIONAL ACETYLENE ASSOCIATION MEETS IN CHICAGO NEXT MONTH

The Board of Directors of the International Acetylene Association has announced the twenty-seventh annual convention of the association will be held in Chicago, November 10, 11, 12. This association includes in its membership the manufacturers of carbide, acetylene and oxy-acetylene equipment of all kinds. Their annual convention is regarded as one of the most important events of the year in the welding industry and is always productive of papers and discussions which furnish valuable information to the industry and looks forward to the further extension of the market for the products manufactured by the members. The following tentative program has been announced:

Wednesday, November 10th

Morning

Formal program.

Dean Wendt, Penn. State College (Keynote speech).

There will be other notable speakers at this session.

Afternoon

Meetings of special committees.

Discussion of Generator Construction Rules.

Thursday, November 11th

Morning

Industrial Production Applications by J. L. Anderson, industrial engineer, Air Reduction Sales Company. This paper will give applications of automatic welding to shipbuilding; the welding of aluminum goods; the manufacture of farm machinery; the production of domestic refrigerating apparatus and the welding of steel household furniture.

Afternoon

Address by Dr. Adolf Krebs, consulting engineer, General Welding & Equipment Company, Boston, Mass.

Address by Prof. Herbert L. Whittemore, chief engineer, Mechanics' Section, Bureau of Standards, Washington, D. C.

Friday, November 12th

Morning

Discussion of the competitive situation in so far as it affects the various welding processes now in use. This will be a round table dicussion led by G. O. Carter, consulting engineer for the Linde Air Products Company. Engineers from manufacturing plants using various processes will take part in this discussion.

Afternoon

Address, "Motion Pictures and Lectures as a Means to Present the Welding and Cutting Process to the Public" by G. Harcke, Air Reduction Sales Company, New York.

Under Water Cutting (motion pictures).

Demonstration of Liquid Oxygen.

The theatre party and the annual banquet will be features which no one can afford to miss.

Plans should now be made by all members and others interested to attend this convention in Chicago and help make it the most interesting and constructive convention yet held by the association.

AIRCO ACQUIRES DAYTON OXYGEN PLANT

Air Reduction Company, Inc., has acquired all the assets of the Dayton Oxygen & Hydrogen Products Company of Dayton, Ohio, thus adding another plant to the chain of 52 plants and 169 warehouses that renders service to Airco customers throughout the United States. The Dayton plant will furnish a new production and distributing point for the Air Reduction Sales Company to serve customers in the southwestern section of Ohio with Airco oxygen and other gases used in welding and cutting. The plant went into operation under Air Reduction management October 15.

Gas Welding Alloy Steels

The Welder Who is Willing to Study the Metallurgy of the Ferrous Alloys Will Learn How to Weld Them All Successfully

By Will Stewart

A CUSTOMER enters with a broken article and hands it to you; it may be Malleable, Cast Iron, Chilled Iron, Wrought Iron, Low Carbon Steel, High Carbon Steel or Alloy Steel.

Oftetn it is a commonplace article and you know just what kind of iron it is. If you are an experienced welder and know that fractures always should be ground out before the article is set up on the welding table, you will step over to the grinding wheel and gently press the fracture against the wheel. By the amount of pressure you have to exert to produce sparks, and by the length and color of the sparks, you will learn just what type of iron it is.

The Spark Test

If it cuts easily, yet wants to follow along the direction the wheel is rotating, and the sparks look like long, red blades of grass, you have either a piece of Wrought Iron, Low Carbon Steel or Malleable Iron in your hands. You can weld it using Low Carbon or Norway Iron filler rod; but if it is Malleable you will have to braze it.

Cast Iron and the inner core of Malleable Iron when pressed against the wheel grind away fast, and seem chalky; the spark thrown off is blood red and short in length, and if any of the fine dust gets in your nose a sharp, acid, burning smell results.

Chilled Iron, High Carbon Steel and Alloy Steels demand that strong pressure be exerted or the piece will skate on the wheel, the resulting sparks are luminous white, have forks and branches like a pine tree, and crackle and send out an odor similar to that of the electric arc.

The greater the amount of carbon held in solution, the whiter the sparks and the greater the branches. Cast Iron contains about 4.00 per cent carbon, foundry unannealed White Cast Iron for Malleable contains 2.25 per cent to 2.75 per cent carbon, while Tool Steel contains 0.85 per cent up, High Carbon Steel ranges from 1.00 to 1.50 per cent carbon and is always cooled so quickly that the carbon held in solution has no time to separate from the iron to form graphite as it does in Gray Cast Iron.

Thus the white luminous high carbon spark is only found in steel that hold the carbon in solution, which when mixed with the iron tends always to produce a characteristic spark that is always the same in the same type of metal.

Alloy Steels tend to throw a spark that is colored by the metal added to the iron. But the welder will have little to do with this type of steel as it is seldom possible to weld them satisfactorily.

All Alloys Can Be Welded

Knowing that there are some who will smile with derision at the above statement, I will explain. Alloy Steels can be welded successfully. I have made a number of articles that are now in daily use of High Carbon Steel, Chrome Vanadium and Chrome Nickel Steels.

You must know the exact proportion of the different metals that go to form the Alloy, then you must have a filler rod of the same metals. You must know the exact melting point of the Alloy and be able to recognize it even though your eyes are covered by dark glasses.

Next comes the preparation; the parts must be ground so that the butting ends present a wide V. If the article is more than ¼-inch thick, both sides should be ground. If both sides are ground there will be less chance of warpage.

Now for the regulators and torch. They must not fluctuate more than a couple of ounces. The torch must deliver a neutral flame and all the time the torch is being directed upon the work, it must be watched that the inner cone does not show an excess of Oxygen.

Heat Treatment of Welds

Alloy Steels are sluggish and care must be taken that oxide is not trapped. It is best to puddle as in welding Cast Iron. After welding it is well to wash the welded section, to smooth down and fill up the high and low spots. It is beneficial for the welded section to be reheated thoroughly, and then it must be set aside and let cool naturally.

Then it is taken and reheated to forging heat, which is much lower than welding heat. It must be heated slowly so that the interior will have a chance to get as hot as the outside. It should then be taken to the anvil and hammered. As the heat dies out the blows should grow lighter and lighter and stop at dull red; this will close the grain and give the weld a grain similar to that of the rest of the article.

It should be laid on a level surface (so it will not warp) and let cool. When cool it should be ground and finished to size. If warped it should be straightened. Now reheat the ENTIRE PIECE to at least a BRIGHT RED and when thoroughly heated dip it in the cooling medium (water or oil) and hold there until entirely cool.

Now we take it to the polishing wheel and brighten it up and then return to the heating unit for tempering. Tempering or reheating is for the purpose of reducing the brittleness of the article. The degree of temper that we give it will depend on the use to which the article is to be put.

We gauge the heat of the article by the color that comes on the polished surface: 450 degrees, straw; 500 degrees, brown-yellow; 530 degrees, light purple; 550 degrees, purple-blue; 580 degrees, polish blue; 600 degrees, deep blue.

Uniform Heat Necessary

It sounds easy, don't it? Yet few welding shops have equipment that can heat a six-inch article uniformly red all over at the same instant. To heat a long article by steps always causes sections of it to become hotter than is needed, and too many operators when this happens, let the over-heated piece cool down to the right color and then douse in the cooling medium. They don't realize that Carbon Steel always takes the grain formation of the highest heat given it and until it has had a chance to cool and is again reheated to the right heat, the over-heated section will still keep the coarse grain given it by the high heat.

Finer Grain Secured by Hammering

The Cooling Tank has to be of such a size that the liquid will stay cool even though it is repeatedly used (pumps are generally used). Too few welders realize that welding heat leaves the section of the weld in no condition for strength, as the grain of the section is in its most coarsest size. All auto parts (axles, etc.) are roughly forged to shape and this is a great help in closing the grain of the steel, but that added metal from the filler rod is but cast in the weld, is loose in texture and unless this section is hammered, no matter what kind of reheating and tempering you give the piece, this section will still show a coarser grain than the rest of the forged article.

So it just amounts to this: If you have the equipment, the right filler rod, good welding equipment, and a careful welder, you can weld almost any piece of Alloy Steel that comes to your shop.

Brazing Alloy Steels

Hand the average welder any article of High Carbon Steel

or Alloy Steel and he will reach for the Tobin or Manganese Bronze and if you ask him if the work is guaranteed, you will learn that if it breaks in the weld (braze) it will be fixed free.

Iron and steel expand when heated and the minute pores open; red heat is hot enough to cause this. The welder should remember that his colored glasses make an enormous difference in the color. It is by the shade seen with the naked eye that I speak of. You must raise and lower your goggles till you can gauge the right shade.

When the article is red hot, the welder adds bronze from a flux coated rod. This flows into the open pores of the hot iron and then when the article is finished and is set away to cool, the iron contracts, causes the pores to close, and they grip fast onto the roots, as we might say, of the bronze, and hold it fast.

When a strain is put on this rooted junction of the two dis-similar metals, if the strain is great enough to overcome the tenacity of either of the two metals, they rupture and the bronze is torn from its bed. The iron half of the rupture usually shows up silvery bright and if it is cast iron, often small sections of the brittle iron are torn out and are found adhering to the bronze.

In cast iron brazing, if you will drill a number of small holes and tap them and screw threaded studs, or screw in machine screws and leave the heads on (but screw them far enough down that the bronze will entirely cover the heads) a more lasting job will result.

In olden days brazing was about the easiest method of securing two sections of metal together and very satisfactory jobs were turned out. Today, however, with the Oxy-Acetylene Torch with its heating power of over 6,000 degrees of heat, the average welder that does much steel and cast iron welding, is sadly out of luck if he applies bronze by welding methods.

Why Some Bronze Welds Fail

For he is used to heating the section of the article to a molten heat, so when he tackles a brazing job he unconsciously heats it too hot and the resulting braze is reddish-yellow in color and often porous and brittle.

Tobin Bronze is composed of (approximately) Copper, 61%; Zinc, 28%; Tin, 1%. Copper melts at 1,980 degrees and when molten has a great affinity for oxygen. The oxide tends to sink into the molten mass, and the resulting cooled metal is honey-combed and brittle. Zinc has a melting point of 785 degrees and if heated above its melting point will volatilize and send up dense white clouds of zinc oxide, that are very injurious to the membrane of the nose.

So with Tobin Bronze melting at 1,690 degrees you will have to be very careful that you do not get the article to too high a heat not let your torch flame remain directed against the filler rod. The flame should be kept constantly and slowly moving about the part that you are brazing. The filler rod should be dipped often in the flux, and when metal is to be added the rod should be rubbed against the bottom of the pool of molten metal and melted by the heat of the molten metal.

There are, I admit, a great number of articles that have to be brazed, but, too, there are many that are needlessly brazed because the welder knows of no other method that will answer satisfactorily. For the last three years I have been welding iron and steel articles without using bronze, and very seldom indeed did one ever come back.

Using the Cast Iron Filler Rod

Cast Iron! That lowly, brittle member of the iron family, was what I used. Carbon as you know will be dissolved in molten iron and ordinary iron will hold in solution approximately .89%. Above that amount, the carbon as the iron cools, is under some conditions separated from the iron and forms graphite.

Because of this power of iron to absorb carbon, we have that useful metal, Malleable Iron, and because of the attraction of iron for carbon, you may weld steel of lower carbon content and have an intimate similar union between the two and the cast iron bond is lower in carbon content and a great deal less brittle.

Sheet steel that goes to form metal boxes of various sorts can be metal riveted by means of an overlap on one of the sections, with holes punched or burned through. Butt welds may be used; warpage is less than when brazing is resorted to and you may hammer the welded sections and never rupt the weld.

Take the flux coated cast iron rod (it must have silicon in it) and set it in the center of the hold and direct the flame against the filler rod. The iron melts down and joins with the thin sheet that has become red hot from the reflected heat of the flame. Then wash over the molten pool and repeat the operation with the next hole.

In butt welding you do the same, the flame playing only on the filler rod. "Cut-outs" of cast iron may be attached to the thin steel exhaust pipes by the same method as above, and you will never burn a hole in the thin pipe unless your hand is shaky.

High Speed Steel Bits that have become too short for the Armstrong tool holder to grip, may be taken and welded to the tip of a low carbon forged tool. The cast iron runs on like brass and no care need be taken other than to set it away to cool.

An Experience With Welded Bits

I saw one of my welded bits stand such a test as I had no doubt would separate the two types of steel. An auto flywheel with only the stubs of the starter teeth remaining, was chucked in the lathe and the back gears meshed. A coarse feed of about ⅛-inch was set, and, Thump! a pause, Thump! when the tool bit engaged the edge of the stub tooth, the belt slipped and slapped and then the chip of cast iron curled up and dropped down, and so on until the teeth had all disappeared. The jerky movement of the laboring lathe was so bad that the very building shook and I could not work until the cutting was finished.

About a month later the same tool bit was ground down so that only about ¾-inch of High Speed Steel was left and another flywheel was chucked. This time I stood by. I knew that the cast iron bond could not stand the strain and I wanted to see just what would result and what the fracture would look like. But I did not find out! The contrary thing just took the stubby teeth as they came along and when the cut was finished it was laid on the rack, still in good shape.

So, to sum it all up, EXPERIENCE has taught me that if one wants to do good welding, he must take pains with his work! and have good equipment, and as good welding supplies as he can procure! And he must add to this, Knowledge of the metal that he is working with, forget his successes and remember his Failures, that he may profit by them by never repeating them. And take suggestions from anyone who comes along, no matter how little he knows about welding.

For often it is the answering of a question from some ignorant two-legged question mark, that sets us thinking, and to think and study will enable us to solve most any difficult problem that comes before us. But books by other thinking men are often very helpful, too.

(Note:—This is the second of a series of articles by Mr. Stewart. The next will describe some interesting and unusual work he has been doing in his own shop, and includes all operating details.—Editor)

FEDERAL PRODUCES NEW VALVE STEM WELDER

The Federal Machine and Welder Company, Warren, Ohio, have recently announced a new type of resistance welder for welding automobile valve stems. This operation involves welding together of two different metals, namely: cast iron and steel. It is said that the new machine has a production capacity of 4,000 per day.

ELECTRIC WELDING IN THE NINETEENTH CENTURY

The illustration shown herewith is a reproduction of a sketch which was printed in the Electrical World, July 9th, 1887. This is one of the earliest pictures on record of the commercial application of the carbon arc welding process, and is one of the illustrations used in connection with an article entitled "Working Metals by Electricity."

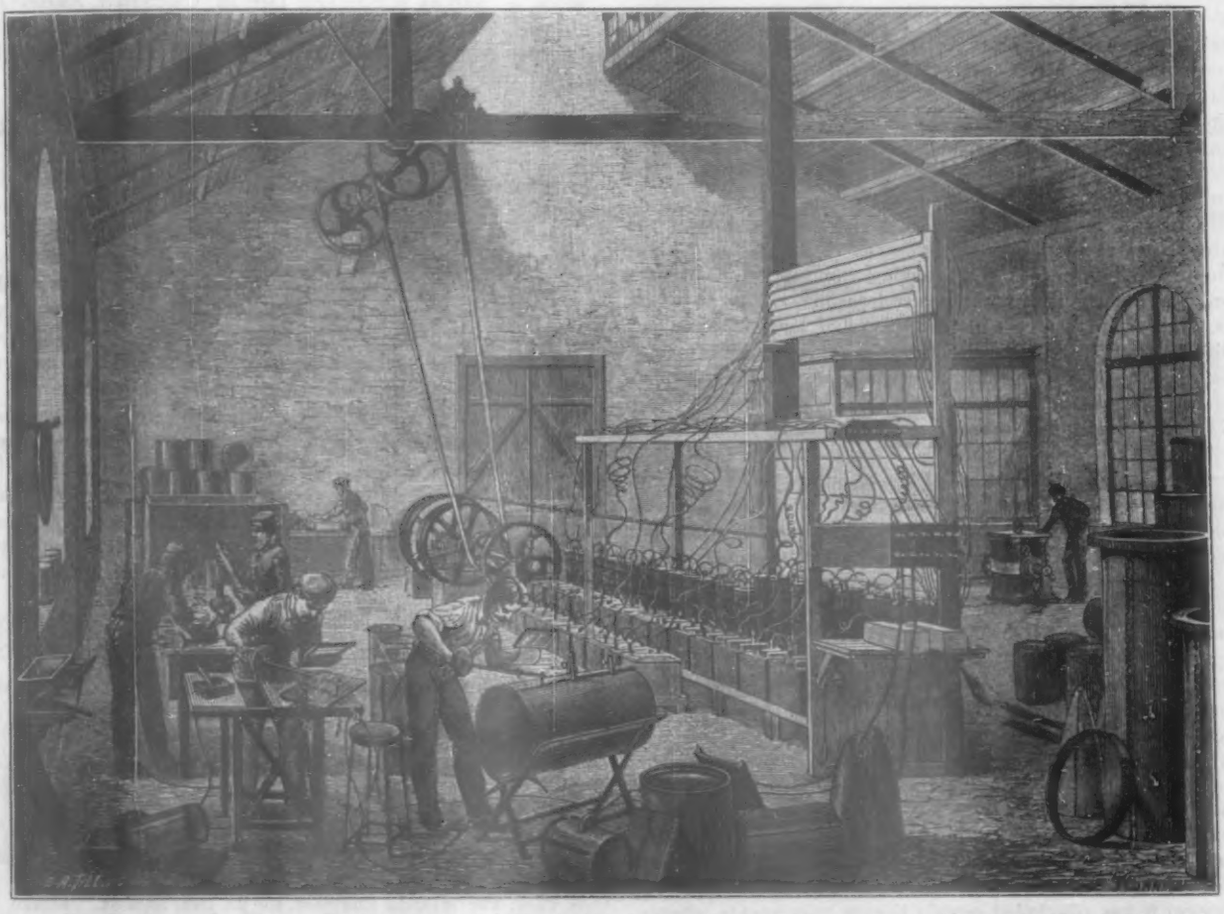
In this article we are told that for soldering or welding two metals a cast iron plate mounted on an insulated table is employed. The cast iron plate is given the name "electric anvil" and the description points out that it is permanently connected with the negative pole of the source of current, the E. M. F. of which must of course be greater than the counter E. M. F. developed in the arc employed. The pieces to be welded are placed upon this anvil in the most convenient position and are thus automatically put in contact with the negative pole. The positive pole of the source of current is connected to an electric light carbon by means of a flexible conductor. The carbon is held in an insulating handle which the workman holds in his right hand.

"In applying the carbon point to the part to be welded," says the author, "the workman closes the electric circuit and then raising the carbon a short distance starts the voltaic arc, which causes the fusion of the metals. He then carries the arc forward by hand over the length of the junction of the two metals and thus welds or solders them completely. During the operation the workman protects his eyes from the glare of the arc by means of colored or smoked glasses mounted in a mask or in a screen which he holds in his left hand." This description of procedure written forty years ago could be used today with very little change.

The author's description of the electrical apparatus used will serve to explain the presence of the huge battery shown in the center of the picture. In this set it is pointed out that the strength of the current obviously varies with the nature of the work to be done. Therefore, in order to maintain a continuous and regular working of the dynamo which furnishes the current the machine is employed in continuously charging a battery of accumulators. By combining a suitable number of the latter the requisite strength of the current is obtained for the different purposes required.

It is pointed out that the carbon arc can also be used for piercing or drilling and cutting. By placing together two metals that have previously been pierced by the arc they can be riveted by placing a pin through the holes and fusing its ends.

The most important application noted is the manufacturer of metal tanks and casks and attention is called to the fact that perfect air tight joints can be obtained, making it possible to obtain tanks sufficiently tight to transport light oils and some chemicals.



Welding Tanks by the Carbon Arc Process Was a Commercial Possibility Forty Years Ago. This Reproduction of an Old Print Shows the Apparatus Used for Producing a Welding Current.

Some idea of the position of arc welding in the history of the commercial applications of electricity can be obtained by reference to a couple of articles on street railway operation which appear in the same issue of The Electrical World with the above mentioned article on arc welding. One short story tells of experiments which were being carried on by the William Wharton Jr., and Company, of Philadelphia, in using electricity as a motive power for street cars. It was calculated that on a fairly level road with curves at reasonable intervals the cars which were used for experiment at that time would run for about five consecutive hours. Another news item reproduces the boast of a newspaper in Montgomery, Alabama, of its enterprise of putting fifteen miles of electric railway

into operation. The changes made in street railway equipment during the past four decades have certainly been no more promising than the improvements which have been made in equipment for supplying arc welding currents.

NEW CONCERN WILL DEVELOP CHROMIUM PLATING

A new company which will be known as the Chromium Corporation of America has been organized to take over the patents of the chromium plating process developed by the Chemical Treatment Company and the Chromium Products Corporation, the latter a subsidiary of the Metal & Thermit Corporation. This new Company will have plants and branch offices in most of the leading industrial centers.

Mr. John T. Pratt, President of the Chemical Treatment Company will continue in that office and also be Chairman of the Board of the new Corporation of which Dr. F. H. Hirschland will be President. The latter is also President of the Metal & Thermit Corporation. Vice-Presidents in charge of operations will be Mr. Louis C. Owens, Jr., and Mr. Richard Loengard. Dr. Erich A. Beck is also a Vice President. In addition to the above officers, the directors will consist of a prominent and financially strong group of men.

In announcing the formation of the new corporation, Mr. Pratt said:

"Manufacturers of metal products have followed with the greatest interest the rapid development of chromium plating during the past few years. Knowing the properties of cromium, particularly its extreme hardness and ability to resist acids, high temperatures and all sources of tarnish, corrosion or discoloration, they have felt that it would only be a matter of time before chromium plate would become a standard finish for many types of metal products.

"The two companies whose chromium plating interests are now being taken over by the new Chromium Corporation of America have been the pioneers in the commercial development of this new art. In taking over the Fink and Grube patents, as well as others controlled by one or the other of the companies mentioned, the Chromium Corporation of America will own or control strong basic patents covering chromium plating under all conditions which are commercially feasible. It will also be allied with the rapidly developing German interests.

"Operating under the basic Grube process patent the Metal & Thermit Corporation, and later its subsidiary, the Chromium Products Corporation, has maintained and operated an extensive and well-equipped chromium-plating plant 'in Jersey City in which it has been producing chromium plate in considerable volume for manufacturers of such products as plumbing fixtures, hardware, brake drums, reflectors, steel tubing, bearings of various types, electrical contact points, heat control devices, radiator shells and various automobile accessories. In addition it has concluded certain license agreements whereby manufacturers who will use chromium plating in large volume are enabled to apply it in their own plants.

"Working along similar, if not exactly parallel, lines the Chemical Treatment Company, operating under the process patents of Dr. Colin G. Fink, the eminent electro-chemist of Columbia University who is internationally famed for his basic discoveries in chemical-metallurgy, has built up a large business and wide acceptance for a special type of chromium plating under its trade-name 'Crodon.'

"The Chemical Treatment Company has been producing Crodon in their plants, in New York City and Waterbury, Connecticut, both of which have for several months been working on a two and three shift basis to meet the demands of its clients for protective surfacing.

"Following a vigorous and intensive merchandising policy within a few of the more important fields for chromium plating, this company has succeeded in making Crodon a familiar term to architects, contractors, marine engineers and architects, hospital and hotel executives, automobile manufacturers and many other important groups. This has progressed to such a degree that Crodon is now specified as the finish for fixtures and hardware in a number of the largest hotel and hospital jobs now under way and has been adopted by several important manufacturers as a standard or alternative finish.

"The combination within this new company of the chromium plating interests of the Chemical Treatment Company and the Chromium Products Corporation (Metal & Thermit Corporation) will be an assurance that this new art will be carried forward rapidly to the best interests of American industry.

"The new corporation will also take over, and operate, the Chromium Products plant in Jersey City and the Chemical Treatment plants in New York and Waterbury. Plans are also being formulated for the opening of new plants at Carteret, New Jersey, East Chicago, Indiana, and South San Francisco, in each of which the Metal & Thermit Corporation now has plants, as well as in Chicago, Detroit, Cincinnati, Akron, Philadelphia, Pittsburgh and Cleveland. The company's expansion program contemplates a national service within two or three years.

G. P. A. LUNCH DEVELOPS INTO YOUNG CONVENTION

Last month the directors of the Gas Products Association, Chicago, arranged with the management of the City Club for the use of a private dining room every Tuesday noon. A general invitation was then extended to all local and also all out of town men connected with the oxy-acetylene welding industry in any way, whether members of the Association or not, to attend the noon luncheons whenever possible without waiting for a special invitation. It is desired to have this room serve as a regular weekly meeting place for the gas welding industry. On October 5th a meeting of the Board of Directors of the Association was being held, so there were a number of out of town members present for the lunch. It happened that out of town representatives of several associate members were also present, so the group which gathered for the lunch that day looked almost as large as a convention banquet. Following is a list of those who were at the luncheon on October 5th:

J. M. Cameron, Gas Products Association, 140 So. Dearborn St., Chicago, Ill.
C. W. Brown, Innis, Speiden & Company, 724 W. Austin Ave., Chicago, Ill.
E. D. Findlay, Acme Oxygen Company, Pershing Rd. at Racine Ave., Chicago, Ill.
M. Keith Dunham, Keith Dunham Company, 110 So. Dearborn St., Chicago, Ill.
A. Roy Robson, Paschall Oxygen Co., Philadelphia, Penn.
Geo. D. Purdon, Commercial Acetylene Supply Co., 600 W. Jackson Blvd., Chicago, Ill.
A. S. Bordeaux, The Michigan Ox-Hydric Co., Muskegon, Mich.
S. D. Winger, Gas Products Company, Columbus, Ohio.
O. E. Engler, The Balbach Company, 915 City National Bk. Bldg., Omaha, Nebr.
Gunard Carlson, Wm. Wharton Jr. & Company, 110 E. 42nd St., New York City.
Stuart Plumley, Acetylene Journal, 53 W. Jackson Blvd., Chicago, Ill.
H. S. Card, The Welding Engineer, 608 So. Dearborn St., Chicago, Ill.
Johann Christian Schneider, Treas., The Heylandt Co., Germany.
H. B. Pearson, Burdett Oxygen & Hydrogen Co., 309 St. Johns Ct., Chicago, Ill.
C. J. Haines, Keith Dunham Co., 110 So. Dearborn St., Chicago, Ill.
W. H. Girdler, Kentucky Oxygen-Hydrogen Co., Logan St. & Goss Ave., Louisville, Ky.
M. L. Goodrich, Swift & Co., Oxygen Dept., U. S. Yards, Chicago, Ill.
E. A. Faulhaber, Burdett Oxygen & Hydrogen Co., 140 S. Dearborn St., Chicago, Ill.
Chas. L. Gulick, Wm. Wharton, Jr. & Co., 110 E. 42nd St., New York City.
Otto Adams, Heylandt Sales Co., 140 S. Dearborn St., Rm. 508, Chicago, Ill.
A. J. Russell, The Bettendorf Oxygen Hydrogen Co., Bettendorf, Iowa.
Joseph Halla, National Gauge & Equipment Co., 140 So. Dearborn St., Chicago, Ill.

BRUCKNER LEAVING U. S. GAUGE

R. E. Bruckner, who for fourteen years has been connected with the U. S. Gauge Co., New York City, as sales engineer, resigned his position this month. Mr. Bruckner states that he has made no definite plans for the future but will remain at his home at Park Ave. and First Street, Bayside, Long Island, New York, for a while.

Arc Welds in Structural Steel

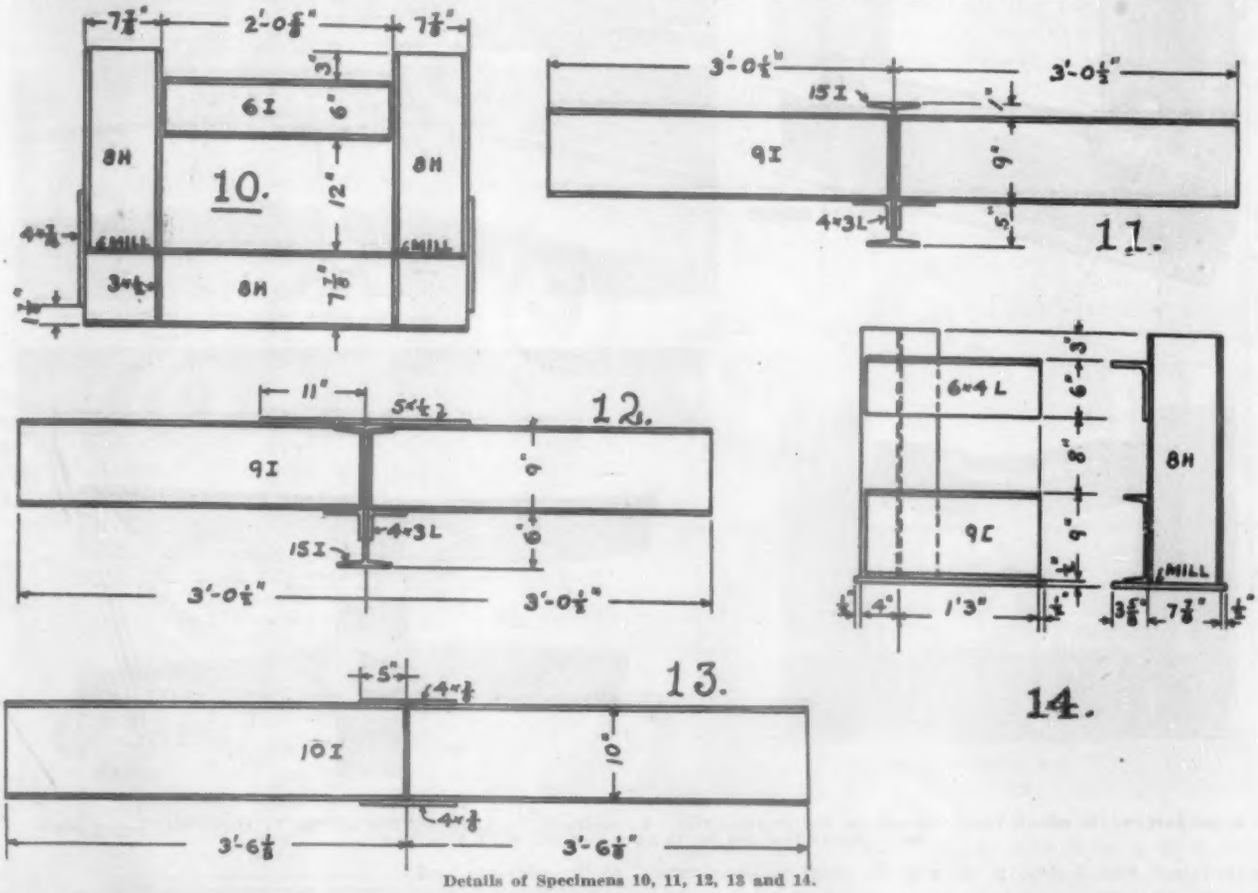
Tests Show That Ultimate Strength of Structural Members Can Be Otained and Special Designs Are Needed

By A. M. Candy and G. D. Fish

(*Continued from September issue*)

Sum of positive and negative bending moments was 1,410,000 inch pounds. Assuming same ultimate positive bending moment as in Test No. 7, negative moment would be 530,000 inch pounds, indicating 60% fixation. Such a degree of fixation could not have been obtained with an ordinary type angle $\frac{7}{8}$ inch or $\frac{3}{8}$ inch thick.

Test No. 10



Details of Specimens 10, 11, 12, 13 and 14.

This is to demonstrate principally a beam subject to shear load. This specimen comprises a 6-in. I-beam weighing 12½ lbs. to the foot, 2 ft. long secured between two 8-in. H-columns weighing 32 lbs. to the foot, 1 ft. 9 in. long each and one base member comprising a similar 8-in. H-section 3 ft. 4⅜ in. long using four web plates 3 in. x ½ in. x 6⅝ in. located in the base member in line with the inside flanges of the columns. Also two stiffening plates 4 in. x $\frac{7}{8}$ in. x 1 ft. long each located as illustrated.

This specimen completed weighs 266 lbs., there being required 7 lbs. 2 oz. welding wire. The total time for making the weld was 3 hrs. 40 min. The span for the load was 2 ft. ⅜ in. The yield point of this specimen being 50,000 lbs. and the ultimate load 83,000 lbs. The load was applied at the center of the specimen on a block 5 in. wide located on the top flange of the I-beam. Failure in this case took place by web crippling of the I beam.

Test No. 11

This specimen is to illustrate two cantilever I-beams secured to the web of a larger I-bear representing a main girder of a structure. The 9-in. I-beams weighing 21 8/10 lbs. to the foot are 3 ft. long. The 15-in. I-section weighs 49 9/10 lbs. per foot and is one foot long. The two seat angles are each 4 in. x 3 in. x ⅜ in. 5 in. long.

Owing to the very cramped and inaccessible space between the top face of the 9-in. I-beam flanges under the upper flange of the 15-in. I-section, it was next to impossible for an operator to make a good weld at this point where the tension stresses are concentrated. Therefore to assist in welding, wedge blocks were inserted so as to permit the operator to build up arc deposited metal over the end and edges of these wedge blocks thereby producing a tie between the flanges of the 15 in. I and the flanges of the 9-in. cantilever I-beams. This specimen complete weighs 187 lbs., there being required 4 lbs. 2 oz. of welding wire and the total welding time required 2 hrs. 10 min.

The span for loading this specimen was 5 ft. 7⅝ in. The yield point of this specimen was 55,000 lbs. and the ultimate load 64,000 lbs.

Test No. 12

Specimen No. 12 is similar to speciment No. 11 with the exception that the 9-in. I-beams are coped so as to throw the

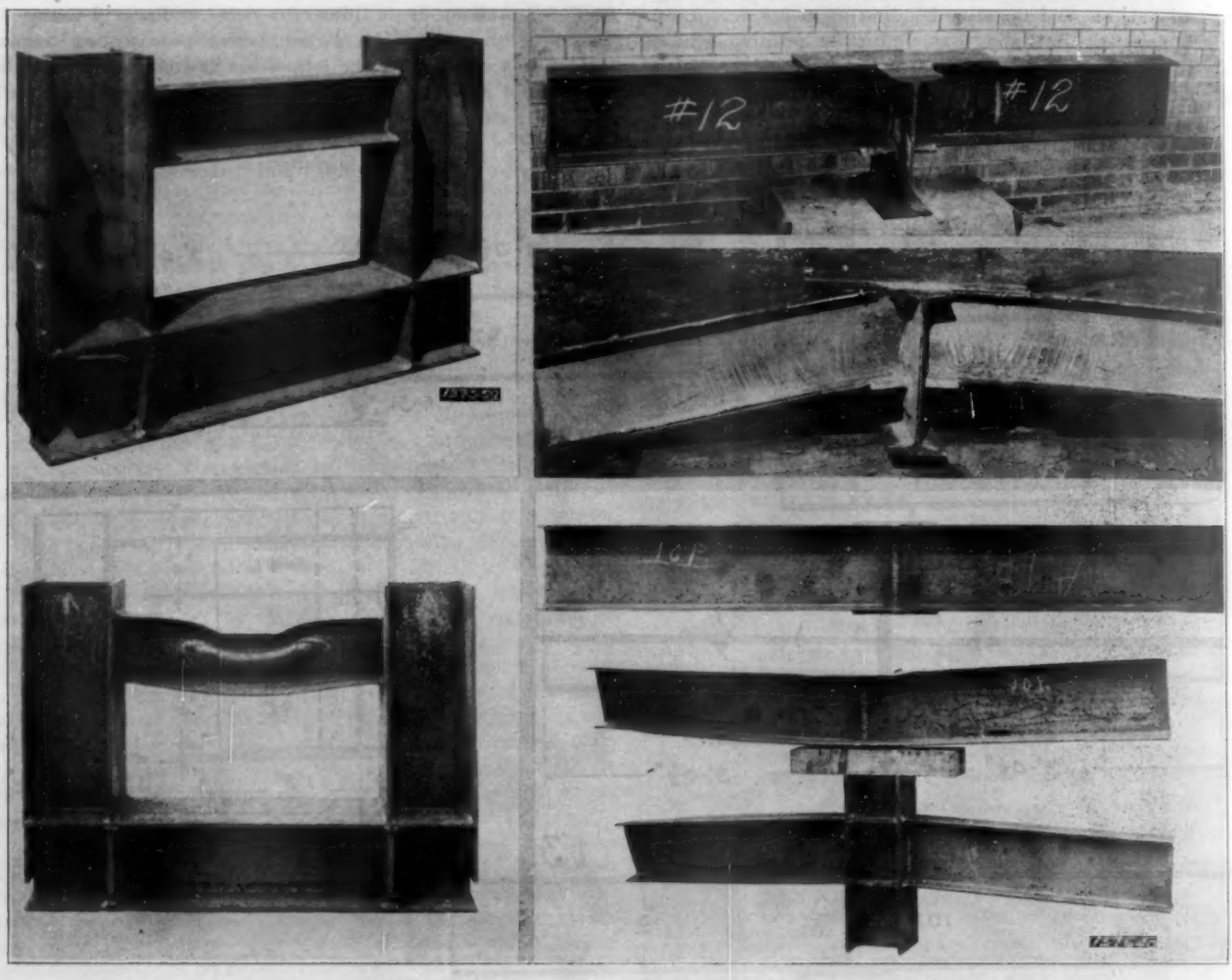
top face of the top flange in a plane with the top face of the top flange of the 15-in. I-beam. A re-enforcing plate 5 in. x ½ in. x 1 ft. 10 in. long is provided across the specimen as illustrated. This re-enforcing plate was wider than the flanges of the 9-in. I-beams which necessitated welding overhead in order to tie the edges of the top flanges to the under surface of the re-enforcing plate. This design should be revised so as to make the re-enforcing plate narrower than the I-beam flanges thereby providing for welding in the downward position.

The total weight of this specimen was 194 lbs., the welding wire required was 3 lbs. 12 oz. and the total welding time 2 hrs. 15 min. The span for loading was 5 ft. 4⅛ in. The yield point of this specimen was 65,000 lbs. and the ultimate load 94,000 lbs. The ultimate failure taking place by progressive tearing of the overhead welded joint between the re-enforcing plate and the top flange of one of the 9-in. I-beams. This specimen shows a very material increase in strength over that of specimen No. 11 namely, approximately 48 per cent.

Test No. 13

Specimen No. 13 represents a test of two spliced 10-inch Bethlehem I-beams, each weighing 23.5 pounds to the foot, 3 ft. long, welded together at their abutting ends and reinforced by top and bottom cover plates, each of which is narrower than the flange of the beam so as to permit downward welding along the edge of the cover plate to the outer faces of the beam flanges. This particular specimen was considered a shop fabricating job, and therefore the beam was turned over so as to make all welding in the downward direction, whereas all of the preceding specimens were welded in the position shown to exactly duplicate regular building construction work.

Failure took place in this specimen by web crippling of the two joined 10-inch I-beams. The elastic limit of the specimen was approximately 65,000 pounds, and the ultimate load was 72,900 pounds. The loading span was 6-ft. 6⅛ in., the load being concentrated at the center on a loading block 3 inches wide. This gives a maximum bending moment of approximately 118,000 foot pounds, and represents a fibre stress of approximately 58,200 pounds per square inch in the beams at the ultimate load.



Upper Left, No. 10 Before Test. Lower Left, No. 10 After Test. Upper Right, No. 12 Before Test and No. 12 After Test. Lower Right, No. 13 Before Test and No. 13 After Test and No. 3 After Test.

The weight of this specimen complete is 180 lbs. 9 oz., it being required to use 1 lb. and 11 oz. of welding wire and the total actual welding time of 1 hr. 15 min.

Test No. 14

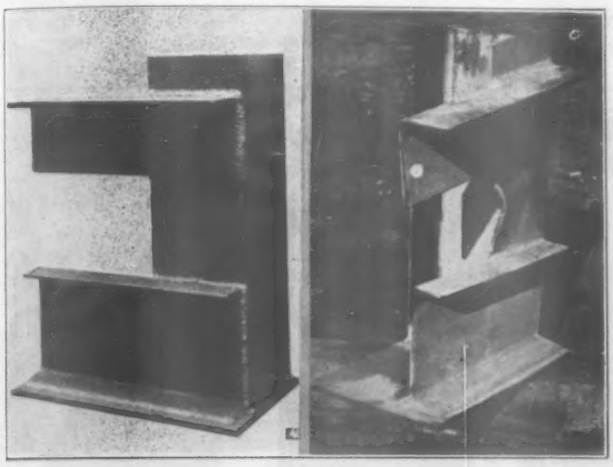
This specimen is to represent a small bracket secured to a column, the bracket comprising a 6 in. x 4 in. x ½ in. angle, 1 ft. 6½ in. long, welded across the end and the top and bottom edges. The 8-in. H-column weighs 32 pounds to the foot and is 2 ft. 2 in. high. Failure took place in this specimen by buckling of the column flange edge, midway between the bracket and the lower supporting channel welded to the column and to the base. The web of the column was also distorted at the same time. The yield point for this specimen was 25,000 pounds, and the ultimate load was 34,600 pounds. The span from the center of the applied load to the edge of the column was 7½ in. The maximum bending moment therefore is 21,700 ft. pounds, and the maximum fibre stress

in the angle is 59,500 pounds per square inch.

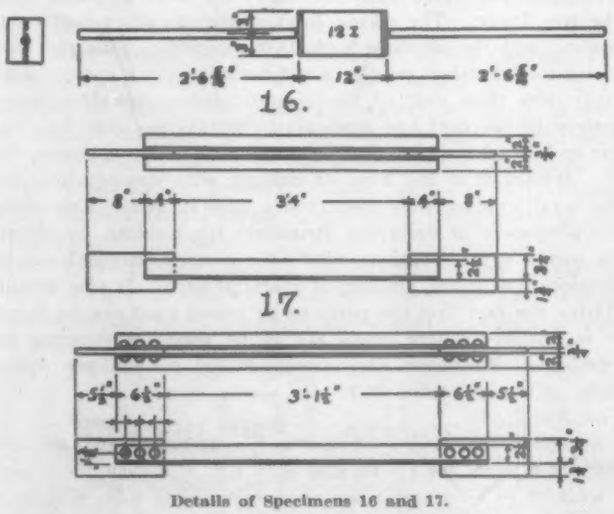
The weight of this specimen is 148 lbs. 8 oz., and the amount of welding wire required is 3 lbs. 3 oz., and the total welding time is 1 hr. 25 min.

Test No. 16

This specimen comprises a pair of $\frac{11}{16}$-in. diameter hot rolled steel rods welded to the two faces of the 12-in. I-beam weighing 31.8 pounds to the foot, 6 in. long. It is to represent the construction where similar rods are to be attached to the bottom faces of the I-beams and girders for hangers to support balconies and mezzanines. Each rod was welded to the under face of the I-beam in an overhead position to exactly duplicate field construction work. The specimen failed by breaking the rod approximately 12 in. from one face of the I-beam section. The yield point was 23,200 pounds, and the ultimate load 35,000 pounds. The amount of welding wire required to weld both rods to the I-beam is 8 oz., and the total welding time 45 minutes.



Left—No. 14 Before Test and at Right No. 14 After Test.



Details of Specimens 16 and 17.

Test No. 17

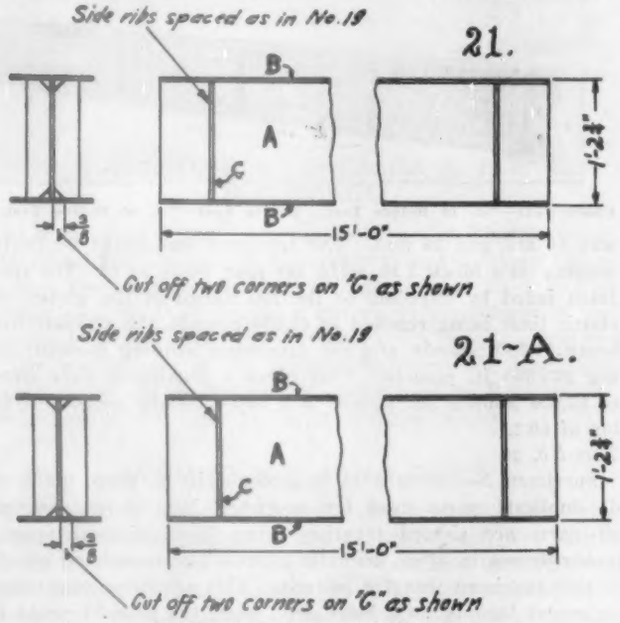
This specimen comprises 2 angles 2½ in. x 2 in. x $\frac{7}{16}$ in. 4 ft. long, welded to two plates 5 in. x ¾ in. by 1 ft. long, the 2½-in. leg of each angle being welded to the plates across the ends of the angle and along the heel and toe of the leg of the angle in contact with the plate. The specimen is for a tension test, the yield point being at 70,000 pounds, and the ultimate load being 94,000 pounds, the maximum elongation being 3 in. in the 40-in. length between shank plates. Failure took place by progressive failure through the 2½-in. legs of the angles, carrying on out through the 2-in. leg.

The complete specimen weighed 48 lbs. 7 oz., the amount of welding wire required was 8 oz., and the actual welding time 20 minutes. All of the welding in this specimen was done in the downward direction, which shows the difference between overhead welding and downward welding by comparing with the amount of metal used and welding time for specimen No. 16. In the case of these two specimens, the amount of welding wire used was exactly the same and yet the welding was 20 minutes in the case of No. 17 against 45 minutes in the case of No. 16. Mean tensile stress, ultimate, 58,000 lbs. per square inch.

Test No. 18

This specimen is similar to specimen No. 17, the difference being that the angles were riveted to the shank plates with ⅝-in. diameter rivets power driven in $\frac{11}{16}$-in. diameter holes.

The elastic limit of this specimen was 60,000 pounds and the ultimate was 72,000 pounds, and the elongation was only 1.12 in., failure taking place through the first rivet hole. The stress strain diagram curves of these two specimens make a very interesting comparison. Ultimate mean tensile stress on gross section 44,500 lbs. per square inch; on net section 53,000 lbs. per square inch.



Details of Specimens 21 and 21-A.

Test No. 19

This specimen comprises a 15-ft. by 14¾-in. deep girder employing one web plate, A, 14 in. x $\frac{7}{16}$ in. x 15 ft. long, 4 flange angles, B, 4 in. x 3 in. x $\frac{7}{16}$ in., 15 ft. long; 16 web stiffener angles 3 in. x 2 in. x ¼ in. 1¼ in. long; 12 filler plates 2½ in. x $\frac{7}{16}$ in. x 8⅝ in. long, and 2 filler plates 5 in. x $\frac{7}{16}$ in. x 8⅝ in. long. The parts of this girder were assembled by welding. The top flange angles were welded to the web plate by intermittent welds 1-in. long on 3-in. centers along the toe of both the top angles. The backs of the angles were welded together and to the edge of the flange plate intermittently using 2-in. long welds on 3-in. centers. At each end the angles were welded solid to the web plate at both the heel and toe for a distance of 3 in. The bottom flange angles were welded to the web plate solid for a distance of 6 in. at each end of the toe, the remainder of the weld along the toe of the angle being 2-in. on 5-in. centers. The heels of these angles were welded solid and also to the edge of the web plate for a distance of 6 in. The remaining portion of this same joint was intermittently welded 2-in. on 5-in. centers.

The filler plates were welded to the web plate by means of 2-in. long welds at the neutral axis and ½-in. welds at the ends of the filler plates along the web plate. The stiffener angles were completely welded around the entire periphery making contact with the flange angles, and also 2-in. welds at the heel and toe of these angles exactly in line with the 2-in. welds made at the edge of the filler plates to the web plate. The completed specimen weighed 785 pounds. The amount of welding wire required to complete the specimen was 27 lbs. 8 oz. The total time to complete the specimen was 14 hrs. and 10 min. The specimen was tested by center loading on a block 5 in. wide, the span being 14 ft. The specimen failed by crippling of the top flange of the girder, the elastic limit being reached at 65,000 pounds, the ultimate load being 77,200 pounds, and the maximum bending moment being 270,000 ft. pounds. This gives a maximum fibre stress of 53,800 pounds per square inch based on the section modulus of 60.2.

Test No. 20

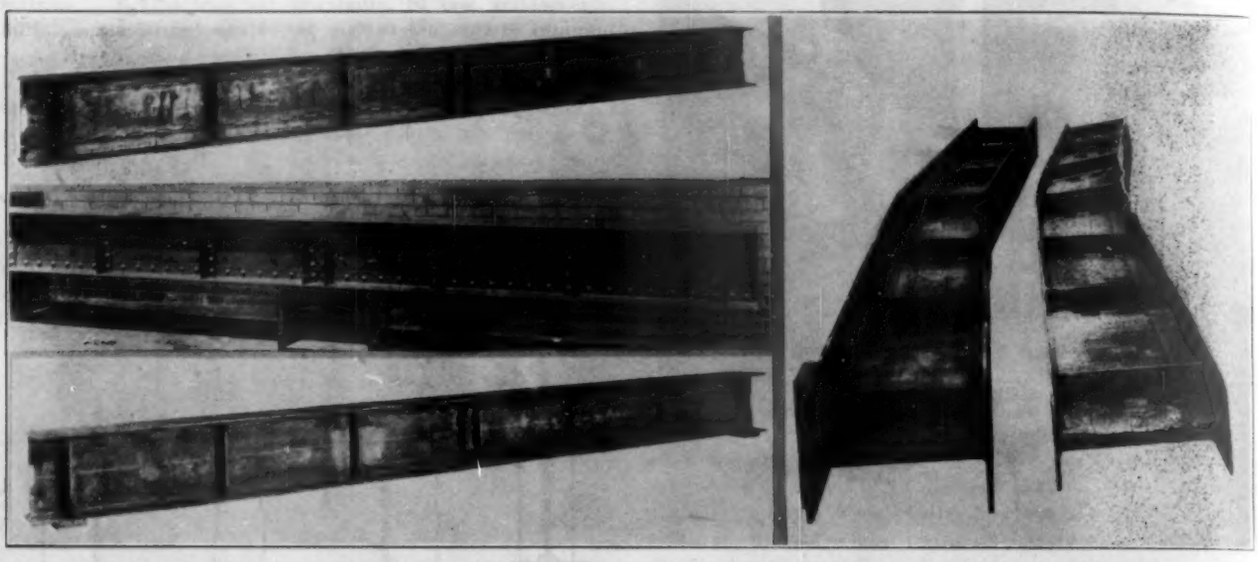
Specimen No. 20 is a 15-ft. girder 14⅛ in. deep, made up of duplicate parts used for specimen No. 19, except that all parts are riveted together using ¾-in. diameter rivets, power driven in ⅞-in. diameter holes. The completed weight of this specimen was 798 pounds. This specimen was tested by center loading on a block 5-in. wide, the span being 14 ft. and ⅛ in. Failure took place by buckling of the top flange, the yield point being 55,000 pounds, and the ultimate load being 68,900 pounds. A duplicate girder was also tested, the span being 14 ft. ⅛ in. The elastic limit was reached at 60,000 pounds, the ultimate load being 74,000 pounds, the depth of this girder being 14⅛ in. Maximum fibre stress, ultimate, for first specimen, 47,400; for second specimen, 51,000; section modules for both specimens, 61.1.

By comparing these figures with those for specimen No. 19, it is interesting to observe that although all parts joined were exactly the same, the welded specimen had a higher yield, point than either of the riveted specimens, and also an ultimate load carrying capacity appreciably above that of the riveted specimens. Allowance should also be made for the fact that the depth of the welded specimen, namely No. 19, was less than either of the specimens No. 20, causing 1½ per cent les section modulus.

Test No. 21

Specimen No. 21 is a specimen desigined strictly to take all advantage of the possibilities of joining structural steel members by the use of arc welding. In this respect it is entirely different from No. 19, which is simply a riveted design welded.

The specimen comprises a web plate, A, 14 in. x ⅝ in. x 15 ft. long; 2 flange plates, B, 10 in. x ⅜ in. x 15 ft. long; and 16 deb stiffener plates 3 in. x ¼ in. x 1 ft. 1¾ in. long. The top flange was welded to the web plate continuously along each side of the web plate. The bottom flange was welded to the web plate solid for a distance of 6 in. from each end and then intermittent welds 2 in. long on 4-in. centers the rest of the distance on each side of the web plate. The web



Upper Left—No. 19 Before Test. Center Left—No. 20 Before Test. Lower Left—No. 21 Before Test. Right—No. 19 and No. 21After Test.

stiffeners were welded solid to the flanges around the entire periphery at each end of each web stiffener. Each web stiffener was also welded 2 in. on each side at the neutral axis and at intermediate points 1 in. long at each side of each stiffener halfway between each stiffener and the flanges of the girder. This specimen was tested by center loading on a block 5 in. wide, the span being 14 ft. Failure took place by buckling of the top flange. The elastic limit of the specimen was 65,000 pounds, and the ultimate load, 78,000 pounds. This specimen had a total finished weight of 656 pounds, which is very materially less than that of the riveted girder, namely approximately 18 per cent and approximately 16½ per cent less than the weight of the riveted design welded, namely specimen No. 19. A total of 30 lbs. 2 oz. of welding wire was required, and the total welding time was 12 hrs. and 33 min. This shows the advantage of designing structures for welding, by placing the metal in the locations where the greatest strength can be developed with the amount of material used. It also demonstartes the fact that the parts to be joined need not be lapped as is required where rivets are to be used for securing the members. Maximum fibre stress, 52,700 pounds per square inch, section modulus 62.2

Test No. 21-*A*

Specimen No. 21-A is similar to No. 21 except that the web stiffening plates are 4½ in. x ¼ in. x 1 ft. 2 in. long, there being a total of 20 used and a top reinforcing plate 9 in. x ⅝ in. x 6 ft. long was welded to the top flange. This plate was welded solid across each end and solid along each edge from the center of the girder to a point 1 ft. 2 in. from the center of the girder. The remaining length of the edge of the plate was welded intermittenly 2-in. welds on 4-in. centers. This girder had a completed weight of 795 pounds, and required 30 lbs. 12 oz. of welding wire to complete the welding work. The total welding time was 16 hrs. and 50 min. This specimen failed ultimately by buckling of the top flange, the top cover plate blistering away from the flange at the center where it

was tied into the web plate. This blistering was approximately ½ in. in depth and did not result in the cracking of any of the welds. The elastic limit of this specimen was reached at 60,000 pounds and the ultimate load was 110,350 pounds. A very interesting feature developed in connection with this test, namely when the ultimate load was removed from the girder it sprung upward a distance of ¾ in. before coming to rest. Some very interesting comparisons can be made between this girder and the two preceding girders, 19 and 20, which will show the very decided increase in strength which can be obtained by properly designing to take advantage of the possibilities of arc welded construction. The maximum bending moment in the case of this specimen is approximately 386,000 ft. pounds. The maximum fibre stress in tension would appear to be 69,300 pounds per square inch, based on a section modulus of 66.8; but the buckling of the top flange before ultimate load was reached would naturally lower the neutral axis below the calculated position, so that the figure given above for maximum tensile stress is undoubtedly much too high. At the elastic limit, the figure for tensile stress is 37,700 pounds per square inch.

The design of the test specimens described above, and the design for the welded steel building for the Westinghouse Electric & Manufacturing Company at Sharon, Pa., were produced by Mr. Gilbert D. Fish, consulting structural steel engineer, cooperating with the arc welding engineers of the Westinghouse Company. This whole series of test specimens and the design of the Sharon building has been made possible through the foresight of Mr. W. S. Rugg, vice-president in charge of engineering, who for some time past has appreciated the possibilities which lay in the use of arc welded structures.

All material for these test specimens was furnished gratis by the American Bridge Company, and was specially prepared under the direction of Mr. Marshall Williams, assistant to the president of that company. Complete data upon the physical properties of all of this steel, including tensile tests and chemical analyses were also supplied, and great care was taken in selecting the steel material so that insofar as possible, it would be from the same heat so as to secure uniformity in comparing the various specimens.

All of the testing work was carried on at the Carnegie Institute of Technology by Mr. J. M. Daniels, instructor in charge of the Materials Testing Laboratory, and his assistant, Mr. Arthur Haeppel. The actual welding of the specimens and all records of tests were carried out under the directions of Mr. A. M. Candy, welding engineer, and Mr. C. T. Eakin, of the Material and Process Engineering Department of the Westinghouse Company.

The Westinghouse Electric & Manufacturing Company hereby desires to record acknowledgment of the service rendered in this work by all of the above mentioned parties and assistants working under them.

NEW CHEMICAL CATALOG OUT

The Eleventh Edition of the Chemical Engineering Catalog has just been published by the Chemical Catalog Co., 19 E. 24th St., New York. In the new edition the classified directory has been enlarged and now contains the lists of more than 2,000 manufacturers. The catalog pages, of course, contain a great mass of information of a specific nature regarding various products used in the chemical engineering industry. The book contains 1175 9x12 inch pages and is printed on a good strong paper and bound with a flexible imitation leather binding. A valuable feature of the book is a special index at the end which contains reference to the best literature on chemical subjects, together with a list of technical and scientific books.

STELLITE SAVES 27 HOURS ON ONE WELL

The use of stellite for facing the edges of oil well bits has been mentioned a number of times, this being an important use for the alloy. An article in one of the oil magazines gives some interesting figures on what sort of savings are accomplished. It is pointed out that the use of stellite has cut down the number of bits used in drilling the 9⅞ inch hole from 15 to 6. Allowing 3 hours' time for the round trip of drilling out and going back into the hole when changing a bit, this means that the use of the stellite facing has accomplished a saving of 27 hours' drilling time on a single well.

CAUSTIC POTASH FOR LIQUEFACTION PLANTS

Oxygen manufacturers who use the air liquefaction process require a carefully selected grade of caustic potash for use in the purifying towers. Most of the chemicals used for this purpose have been imported, but for a long while there was some difficulty arranging for a source of supply which would provide the chemicals in the right size and packed in containers holding a convenient amount. The Innis-Speiden Company, 722 W. Austin Avenue, Chicago, are now offering to oxygen manufacturers a grade of caustic potash designated as "American Selected." This is imported in large sizes, reduced to walnut size in this country and packed in 100-pound drums. Special attention is given to assure uniformity and furnish material that will best answer the requirements of the plants using caustic potash.

DR. LANGMUIR ADDRESSES A. I. E. E. IN CHICAGO

At a meeting of the American Institute of Electrical Engineers, held in Chicago on September 27th, Dr. Irving Langmuir of the research laboratory of the General Electric Co., Schenectady, N. Y., delivered a lecture on the subject of the automic hydrogen arc. His lecture gave a complete history of the development of the automic hydrogen arc flame, and lantern slides and motion pictures were used to illustrate the application of this flame to the welding of metals.

WEMCO WELDING RODS

The Welding Materials Company has recently been incorporated, with headquarters at 114 Liberty Street, New York, for the distribution of welding rods, electrodes, metallic electrode holders, carbon electrode holders, hand shields, face shields and welding glasses. The welding rods and electrodes marketed by the new concern will be sold under the trade name "WEMCO." Their line includes, altogether, 26 different types of filler materials.

FOUNDRY SHOW AT DETROIT INCLUDES WELDING DEMONSTRATIONS

The 30th annual convention and exposition of the American Foundrymen's Association was held in Detroit the week of September 27th. A technical program of 24 sessions covering every field of foundry activity was prepared. The exposition was an unusually large one, occupying considerable space in the buildings of the State Fair grounds. Welding equipment was displayed and demonstrated by the following manufacturers: Agnew Electric Welding Company, Milford, Michigan; Air Reduction Sales Company, New York; Electric Welding Machine Company, Detroit; General Electric Company, Schenectady, N. Y.; Metal and Thermit Corporation, New York; Alexander Milburn Company, Baltimore; Oxweld Acetylene Company, New York; Weldit Acetylene Company, Detroit, Michigan.

Observation Testing of Filler Rod

A Method of Testing Which Permits the Welder to Determine in a Rough Way the Operating Characteristics and Weld Properties

By J. B. Green*

TESTS may be divided into two classes, Precision Tests and Observation Tests. The first are usually expensive, require laboratory facilities, and generally are so technical that a trained engineer is required to carry them out. Observation Testing can be done without special equipment and by any one familiar with welding who has the desire to study it and understand what it means. It is not an exact method of testing and, at the best, only points out wide differences in quality. It is cheap and quick and, in places to which it is suited, is a very useful method.

Test N°____

OBSERVATION TEST GUIDE SHEET
Oxy-Acetylene Welding Rod.

*Trade Description of Filler Rod*_____
*Date*_____ *Observer*_____ *Weld Properties Test N°*_____

EQUIPMENT
1. Size or Style and Make of Torch_____
2. Tip Size-N°_____ Bore _____ Inches
3. Type of Torch - 1 Low Pressure 2 Medium Pressure 3 Equal Pressure 4 High Pressure

PARENT METAL AND SUPPLIES
1. Parent Metal - Composition_____ Thickness_____ Inches
2. Filler Rod - Composition_____
3. Filler Rod - Finish - 1. Coppered 2. Bare Bright - Diameter_____ Inches
4. Oxygen - Brand_____
5. Acetylene - Brand_____

WELDING CONDITIONS
1. Operator's Skill - 1. Very Skillful 2. Skillful 3. Unskilled
2. Position - 1 Flat 2. Vertical 3. Overhead
3. Pressure - Oxygen_____ pounds - Acetylene _____ pounds
4. Form of Weld - 1. Bead 2. Butt (Bevel____°) 3. Lap 4._____
5. Flame - 1. Strongly Oxydizing 2. Oxydizing 3. Neutral 4. Carburizing 5. Strongly Carburizing
6. Fire - 1. Heavy 2. Medium 3. Light
7. Flux - Quantity_____ Composition_____
8. Shape of Inner Cone - 1. Blunt 2. Short 3. Long 4. Slim 5. Even 6. Ragged
9. Length of Inner Cone - 1/8" - 1/4" - 3/8" - 1/2" - 5/8" - 3/4"
10. Distance tip of Cone to Metal - 1/8" - 1/4" - 3/8" - 1/2" - 5/8" - 3/4"

OPERATING CHARACTERISTICS
1. Flow - 1. Clear and Quiet 2. Clear with Boiling 3. Dirty
2. Slag - 1. Forms Natural 2. Bright Floating Specks 3. Tends to Entrap
3. Deposit Metal - 1. No Boiling 2. Moderate Boiling 3. Violent Boiling.

GENERAL REMARKS

Guide Sheet for Gas Welding Rod.

Factors Affecting Filler Rod Quality

Before describing Observation Testing, it is desirable to understand what factors affect Filler Rod quality and what order of difference in these factors this testing will distinguish. First, Filler Rods may be grouped into the ordinary, round, solid rod and profile rods such as hollow rods, cored rods, ribbed or corrugated rods and the like. As the subject is complicated enough anyway, only the round, solid rod will be considered.

* *Research Department, Chicago Steel & Wire Company.*

There are four, possible, fundamental factors in such a rod affecting the quality. These are the chemical composition and structural arrangement of the materials of the rod itself and the same for the materials on its surface.

Types of Filler Rods

Various combinations of these factors result in what are referred to as the various types of Filler Rods. The chemical composition of the Filler Rod and surface materials is usually the basis of determining the various types, while the structural arrangement is more often the basis of determining variations in quality in any one type. Observation Testing will usually permit distinguishing one type from another but not small variations from any one type. The composition of the surface materials divides all Filler Rod into two classes, Gas Welding Rod having metallic surfaces and Metallic Arc Electrodes having non-metallic surfaces. (The requirements of Carbon Arc welding seem to make the matter of surface materials more or less indifferent) The chemical composition of the rod in most cases determines the type although, in the case of electrodes, the surface must also be considered. The types of ferrous rods may be grouped into the Carbon Steels and the Alloy Steels. The Carbon Steels on the American market may be subdivided into Mild Steel below 20 points carbon, the Medium Steels containing 20 to 60 points carbon, and the High Carbons from 60 to 110 points. The commoner Alloy Steels are Nickel, High Manganese, the Chromium series including Chrome-Nickel, Chrome-Vanadium, Chrome-Molybdenum, the Vanadium, the Silico-Manganese and a host of other steels in less general use. The Mild Steel group, of course, is the best known because it is more widely used. There are three types in this group. No. 6 contains under 6 points carbon and under 15 points manganese; No. 10 contains 6 to 10 points carbon and 30 to 45 points manganese, while No. 18 contains 13 to 18 points carbon and 40 to 60 points manganese. All of these are available in Coppered Finish for gas welding but, as boiling of the weld metal increases with carbon and manganese content, there is not much reason for using any but Type No. 6. For electric welding, Type No. 6 is available in Black Soft Finish while all three types are on the market in Bare Finish, Flux Coated and Surfaced.

Each composition with each surface represents a type of Filler Rod. No attempt is made here to list all the types on the market but merely to mention some of those in more general use for the purpose of indicating clearly what is meant by type. Observation Testing permits, in a rough way, determining the operating characteristics and weld properties of the various types of rods.

Observation Test Guide Sheets

Guide Sheets are essential for Observation Testing because it is impossible to decide what to observe at the same time the observation is made and do a good job of each. If anything approaching completeness is aimed at, these sheets should be prepared by an experienced welding rod designer. This branch of engineering has not been generally recognized and so there are really no accepted standards for judging ability in this direction. Three of the general Guide Sheets as used in the Research Laboratory of the Chicago Steel & Wire Company are reproduced with this article. In research work, it is more often necessary than not to prepare special

sheets for each problem. The Guide Sheets presented here are for general testing. They will not cover all cases but will be found very useful under most circumstances and they give an idea of the large number of points which must be observed in rating welding rod.

Some explanation of these Guide Sheets is necessary. First, will be noted that the tests are divided into those on Operating Characteristics and those on Weld properties. A complete

Test N° ____

OBSERVATION TEST GUIDE SHEET
Metallic Arc Electrode

Trade Description of Filler Rod _____
Date ____ *Observer* ____ *Weld Properties Test N°* ____

EQUIPMENT.

1. Make and Size of Generator _____
2. Type of Generator - 1. Alternating 2. Direct Current 3. Resistor.
3. Type of Generator - 1. Constant Voltage 2. Constant Current 3. Constant Energy.
4. Steadying Ballast - 1. Ohmic Resistance 2. Inductive Resistance 3. No Ballast

PARENT METAL AND SUPPLIES.

1. Parent Metal - Composition _____ Thickness _____ inches
2. Filler Rod - Composition _____ Diameter _____ inches
3. Filler Rod - Finish - 1. Bare 2. Flux Coated 3. Surfaced
4. Coating - Thickness - 1. Very Thin 2. Thin (1/64") 3. Medium (1/32") 4. Thick (1/16")
5. Coating - Composition _____
6. Coating - Binder _____ Color _____
7. Coating - Appearance - 1. Lumpy 2. Smooth 3. Streaked 4. Pin-holed 5. Uniform 6. Not Uniform 7. Opaque 8. Translucent.

WELDING CONDITIONS.

1. Operator's Skill - 1. Very Skillful 2. Skillful 3. Unskilled
2. Position - 1. Flat 2. Vertical 3. Overhead
3. Polarity - 1. Electrode Positive 2. Electrode Negative (Reg.) 3. Alternating.
4. Arc Length - Shortest without breaking _____ inches - Volts _____ - Amps _____
5. Form of Weld - 1. Bead 2. Butt (Bevel ____°) 3. Lap 4. _____

OPERATING CONDITIONS.

1. Arc Steadiness - 1. Excellent 2. Good 3. Fair 4. Poor
2. Size of Molten Drop - 1. Very Small 2. Small 3. Medium 4. Large 5. Very Large
3. Regularity of Flow - 1. Very Regular 2. Regular 3. Irregular 4. Very Irregular
4. Melting Rate - 1. Very Fast 2. Fast 3. Medium 4. Slow 5. Very Slow
5. Penetration - 1. Excessive 2. Deep 3. Medium 4. Slight 5. Very Slight
6. Deposit Efficiency - 1. Very High 2. High 3. Medium 4. Low 5. Very Low
7. Heating of Electrode - 1. Very Noticeable 2. Noticeable 3. Not Noticeable
8. Tendency of Coating to Melt at End of Electrode - 1. Forms Crater 2. Melts even with Electrode 3. Melts ____ inches Ahead 4. Cracks Off Ahead.
9. Fumes - Volume - 1. Excessive 2. Moderate 3. Small
10. Fumes - Character - 1. Odorless 2. Noticeable Odor 3. Agreeable 4. Disagreeable 5. Strong 6. Mild

GENERAL REMARKS.

Guide Sheet for Arc Welding Wire.

test includes both so the Guide Sheets should be numbered and the cross reference noted. It is especially important that this be done on Weld Properties Tests because much important data regarding equipment, supplies and conditions appear only on the Filler Rod Guide Sheet. Requirements in testing the operating characteristics of Gas and Electric Filler Rod differ, so special Guide Sheets must be provided for each. Wherever possible, a bead should be laid down for the Operating Characteristics Test and a butt weld, beveled 45°, for Weld Properties Test. As a great many of the observations are necessarily comparative, it is best to run a test on a good example of a familiar rod and use the Guide Sheets thus obtained as standards for all others. All spaces on the Guide Sheet should be filled in even if only the word "unknown" is written. Often exact information for a space may be unknown but approximate facts are available. For example, the composition of the parent metal could be indicated simply as "Mild Steel" instead of recording the complete analysis. Where a list of comparative ratings are indicated after an item, it is only necessary to draw a circle around the preceding number to make the record. If finer subdivisions are required the use of plus and minus signs may be substituted for the circles.

Often it appears like a waste of time to record the details regarding the Torchbor Generator because, perhaps, there is only one in the shop. Later, however, another is purchased and then, still later, the old Guide Sheets are gotten out for reference and they are found to be meaningless simply because this information or the full date or other details, not important at the time, were omitted.

The items referring to the skill of the operator should be explained. Skill here should not be confused with extent of experience or knowledge of welding. It merely means ability to eliminate from the test variations due to the operator. A man's muscles and his control over them might be such that he could hold a steady, short arc and he should be rated very skillful, although he may know practically nothing about welding in general.

Observation Tests on operating characteristics are usually far more satisfactory than on weld properties and still, much useful information can be obtained in this latter regard. The weld surface is best observed on a straight bead while the bending test is best applied to a butt weld. The hardness of the deposit can be fairly well judged by the filing the reinforcing flush with the parent metal surface. Placing the weld piece then in a vise so that the line of the vise jaws

Test N°____

OBSERVATION TEST GUIDE SHEET.
Weld Properties

Date ____ *Observer* ____ *Filler Rod Test N°* ____

WELD SURFACE.

1. Appearance - 1. Very Smooth 2. Smooth 3. Rough 4. Very Rough
2. Scale - 1. Very Thin 2. Thin 3. Moderate 4. Thick 5. Very Thick
3. Scale - 1. Non-adherent 2. Moderately Adherent 3. Adherent 4. Very Adherent
4. Scale - 1. Stony 2. Brittle 3. Like Coke 4. Like Powder
5. Metal Beneath Scale - 1. Very Bright 2. Bright 3. Dull 4. Very Dull
6. Dimensions of Bead - Width ____ Inches - Height ____ Inches
7. Form of Bead Edge - 1. Blends with Parent Metal 2. Grooved. 3. Curves Back Under Deposit.

BENDING TEST.
(File and break by bending in Vise with Hammer.)

1. Hardness - 1. Extremely Hard 2. Hard 3. Soft 4. Very Soft
2. Tensile Strength - 1. High 2. Medium 3. Low
3. Ductility - 1. Very Ductile 2. Ductile 3. Brittle
4. Fusion - 1. Complete 2. Incomplete (____% Unfused)
5. Blow Holes - 1. None 2. Moderate 3. Excessive 4. Very Excessive
6. Slag Inclusions - 1. None 2. Few 3. Numerous 4. Very Numerous
7. Appearance of Fracture - 1. Fine Grained 2. Medium Grained 3. Coarse
8. Testing Position in Vise - *(Sketch Weld, draw line representing vise jaws, and mark "V"; draw arrow indicating position and direction of hammer blows, and dimension weld position if not central in vise jaws.)*

GENERAL REMARKS.

Guide Sheet for Report of Weld Properties.

bisect the weld longitudinally, the tensile strength can be judged to some extent by the number and force of the hammer blows required to break the specimen. The angle to which the specimen has been bent at break gives an idea of the ductility, and the fractured weld shows fusion, pinholds, slag inclusions and grain structure. When other than regular 45° beveled butt welds in plate steel are tested, either a sketch should be made on the Guide Sheet or numbered

charts of the different type welds, such as are presented in the Welding Encyclopaedia, should be prepared and the proper number recorded. Such charts as appear in the same book showing oxy-acetylene flames are useful to maintain comparative testing standards in this regard.

Some Uses for Observation Tests

The regular use of Observation Testing and recording of results on Guide Sheets will be found a great help to everyone making or using Filler Rod. Even this fairly crude method of testing is complicated but, by first making up the Guide Sheet, then observing the test, and finally, studying the recorded data, it is comparatively easy to comprehend the results. The significance of the Guide Sheets rests on the fact that they permit treating these three stages separately. It is surprising how this simple trick clears up many problems which otherwise would be too perplexing to be solved.

There are very many places where Observation Testing can be profitably applied. Purchases of Filler Rod may be tested as received, in a routine way, by taking one or more rods from each bundle, writing the Test Number on the bundle tag and turning the completed Guide Sheets in to the supervisor. After a little experience, the supervisor can tell almost at a glance what he has in the store room. He can form a very fair opinion as to the uniformity of the rods in a shipment. He can tell within a few hours after a lot is received whether there appears to be any material which is markedly defective and take the proper steps to guard against loss in his shop through attempts to use it.

Observation Testing is a great help in selecting the proper type of rod for any particular job. Shops all too often get into the habit of using a certain type rod, maybe because it is cheap or, sometimes, because it is expensive and therefore must be good. Seldom can a correct selection be made on only one condition, be it price or what not, if a shop is anxious to combine highest quality of its own product with maximum economy of production. Observation Testing permits the supervisor to classify the Filler Rods available on the market into types and intelligently identify all rods of the type most suited, all points considered, not just one or two.

It is often desirable when seeking advice and sometimes necessary when entering complaints to correspond with the Filler Rod manufacturer. This gentleman may be ever so anxious to please but his hands are tied when he gets a letter simply asking what is best for cast iron or advising politely that his rod is no good. If the correspondent were in the habit of making Observation Tests, with Guide Sheets, and used such sheets in reporting conditions to the manufacturer, he would probably get a quick and satisfactory answer. Brevity may be the soul of wit but, when it leads to lack of completeness, it has no place in connection with welding problems. These are inherently complex and a very good way to appreciate this fact is to attempt to lay out a Guide Sheet for an Observation Test. Then, when one is really completed, pause to realize that Observation Testing is crude at the best and that exact data can usually only be obtained by Precision Testing.

ENDRESS COMPANY MAKES DOUBLE PURPOSE TORCH

The Endress Manufacturing Company, Cortland, N. Y., has recently been organized for the manufacture and sale of welding equipment of all kinds. The principle feature of their line is the Endress oxy-acetylene welding and cutting torch. This torch works on the injector principle using low acetylene pressure and is so constructed that the substitution of a cutting head for a welding head makes it possible to use the same torch for cutting which has been used for welding. There is also a complete range of sizes of welding heads making a single handle adaptable to a great variety of work.

D. C. ANDERSON NOW LINCOLN SALES MANAGER

The Lincoln Electric Company, of Cleveland, Ohio, announces the appointment of Dorsey C. Anderson to the position of general sales manager, with headquarters at Cleveland. As district sales manager in Philadelphia, Mr. Anderson formerly directed the Lincoln sales activity on the Atlantic seaboard from Boston to Baltimore, inclusive.

D. C. Anderson.

Mr. Anderson is widely known in the electrical trade of the East in connection with the work he has done in the application of induction motors to machinery, as well as in the application of electric arc welding.

DIRECTED SPARK SAVES BURNS

A notable feature of the Shoot-A-Lite torch lighter, manufactured by the Stevenson Distributing Corporation, New York, is that the spark is really shot forward in a definite direction. Due to this principle of operation the welder's hand can remain at a maximum distance from the point of ignition when he is lighting the acetylene jet. Mr. Wood, President of the Stevenson Corporation, speaks of the number of times this point is mentioned when he talks to welders about the lighter. Their reaction is an expression of satisfaction for the device which enables them to light the torch without any possible danger of a burn. It is this same feature which has been the cause of heavy sales of this device for lighting gas stoves in the home. Even though the chances of getting a burn may be very small the chance need not be taken by any one and the rapid growth in the popularity of this lighter is a sign of present tendency everywhere to take every reasonable precaution against painful accidents.

A Problem in Weld Design

A Single Detail of a Large Construction Is Used to Illustrate the Need for Research in the Field of Structural Steel Welding

STRUCTURAL steel welding has been developing during the past few years into one of the most important welding applications, although it is generally considered that this field is a new and untried one. Misunderstandings of the present state of the art can easily arise if structural steel work is thought of in terms of such structures as skyscrapers and huge bridges.

So a merry battle is being waged between the super-enthusiast who resents any opposition to the idea of welding all the steel work in future skyscrapers, and the unbelieving engineer who once heard of a weld that had failed. Because there is so much promise of rapid progress in this field for both gas and arc welding, it is going to prove a wise policy to be somewhat conservative and avoid mistakes which have slowed up other applications of welding. It would be an especially serious error to overlook the engineering problems involved in welding large structures.

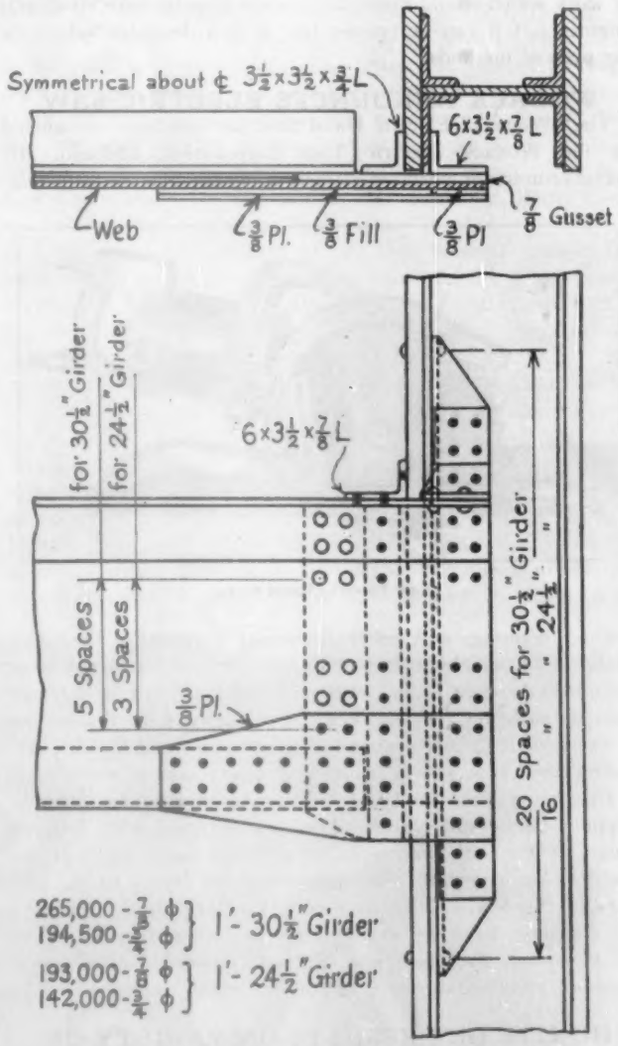
For example, regardless of the proven merits of the welded joint itself, and of repeated demonstrations that welding need not seriously impair the strength of the parent metal adjacent to the joint, its use in large and complicated structures will not be acceptable until a way has been found to design joints which will be adaptable to welding, with equal strength and at no greater cost. On many small structures it is a simple matter to replace rivets with welds. The joints are simple and the factor of safety is large, and welding shows striking advantages on many types of shop work.

Many firms are already engaged in welding small structures, or parts of them, and a number of interesting jobs on a large scale have been completed successfully within the past two years. Undoubtedly the wide publicity given to them has stimulated experimental work in manufacturing organizations who have been on the alert for improved methods of construction. It is on the foundation of these smaller constructions that the future of structural steel welding will grow.

When the discussion turns to larger work, the factor of joint design increases in importance and in difficulty. One reason for this is that riveted joint designs are not suitable for welding, and another is that engineers are trained almost universally to design for rivets only. Shall we send them back to college to study welded joint design, and if so, to what college?

A definite question raised by one architect presents one of many problems in design which are waiting for solution before our super-enthusiast can weld his skyscraper. The question refers to the wind bracing of tall buildings. Here is a structural field open to the welder, where he could replace by a simple operation the complicated operations now executed by means of the present day riveting methods.

The nature of the problem can be estimated from the accompanying sketch, reproduced from a sheet of wind bracing details taken from a twenty odd story structure erected a few years ago. This building had some abnormal connections (the sketch shows only one of a few score different connections) because the plan was an awkward one; but in any tall building, even with a simple plan, the connections as well as the drawings relating to them are rather elaborate and consequently not particularly desirable from the point of view of quantity production in shops. The architect who raised this question considers that if welding could be used, and small connecting bars connected by the flanges to columns in such a way as to develop the strength of the beam the operation would be simple and it would eliminate some very complicated operations. The size of the beams themselves could often be reduced materially, as very often the size of the beam is governed by space to put in the number of rivets required.



What Is the Best Welded Substitute for This Connection?

Here is a field in which welding, instead of cutting in on established structural methods might eliminate undesirable and awkward work for these established methods and at the same time create a business for itself. So it is worth considering as a separate problem, aside from the fact that it is one of the problems ahead of the welding industry, as it ventures forward into the field of heavy structural steel welding.

It is not a matter of simply finding a substitute for the connection which has been chosen to illustrate this discussion,

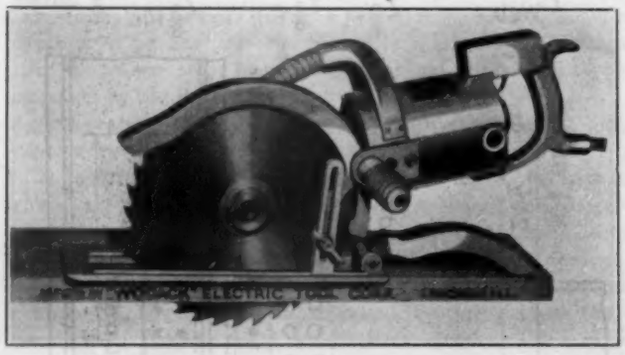
but of determining fundamental principles which can be applied to the great variety of cases encountered in practice. An important consideration is the simplification of field work, which with riveted construction is carried forward "the best way possible."

If this matter of wind bracing alone could be developed (and all questions of strength, cost and control of results settled) the welding process would be able to make a decided step forward in building construction. The mission of the welders would be to connect the beams to the columns, which could be done without getting in the way of the riveters and which would in many cases speed up the entire erection program.

In conclusion, the subject of wind bracing introduces design problems which show the need for research before welding can entirely replace riveting, and also indicates a field of work which would make the process popular with structural engineers if it can be proven that it is a desirable substitute for present methods.

WODACK ANNOUNCES ELECTRIC SAW

The "Wodack" Electric Hand Saw has just been announced by the Wodack Electric Tool Corporation, Chicago, Ill., manufacturers of portable electric tools for grinding, drilling,



New Electric Hand Saw.

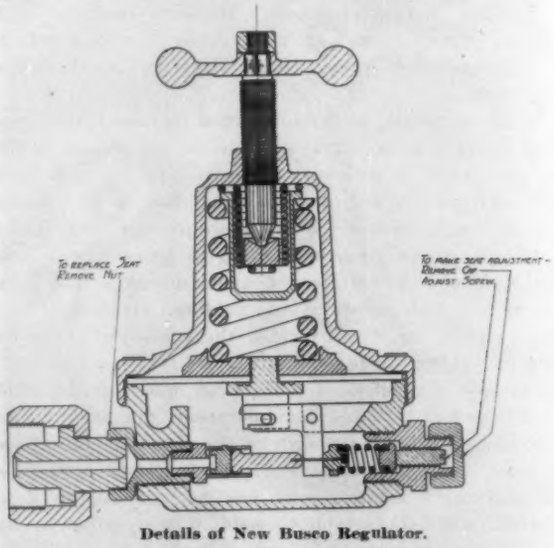
buffing, reaming, and other industrial purposes. This new electric tool, weighing 24 pounds, is fitted with a motor large enough to drive an 11 in. circular saw and still can be operated from an ordinary light socket. A 4 in. by 4 in. timber can be cut with it in three seconds. Contractors and builders are finding this new saw a wonderful labor saving device. It is also being used by large industrial concerns for opening shipping boxes and crates. The saw is fitted with a depth gauge so it is only necessary to saw the exact depth of the board or box cover, thereby preventing any injury to the contents of the box. F. L. Rogers & Co., 440 South Dearborn St., Chicago, have been appointed exclusive distributors of the new saw, and have prepared an elaborate folder giving complete specifications and list of important uses.

HOXITE GET RESULTS ON VARIETY OF METALS

The Hoxite Company of Stamford, Conn., manufacturers of HOXITE, a flux for all metals, reports increasing sales with a large number of users advising of most successful results on cast iron, steel, brass and aluminum. Its increased use in welding broken cast iron gear teeth, showing a homogenous weld free from blow holes and the ability to easily machine the welded metal, are commented upon by users. Its use on low grade castings and its clearing such castings of impurities is also spoken of. On aluminum crank case repairing unusual and most satisfactory results are reported. Freedom from disagreeable fumes and adhesion to the welding rod are other features commented upon.

NEW FEATURES OF BURDETT REGULATORS

Important changes recently made in the design of Burco regulators made by the Burdett Manufacturing Company, of Chicago, are illustrated in the accompanying sketch. The first feature is the east of replacement of the regulator seat. In this regulator the seat is changed by unscrewing the nut in back of the tank connection nut. When this is removed the old seat can be dropped out and a new one inserted without the use of any tools. Then the nozzle is screwed back in. It is not necessary to remove the bonnet or disturb the diaphragm in any way. Another feature of the construc-



Details of New Busco Regulator.

tion which is plainly indicated in the diagram is the ease of adjustment of the regulator seat. The procedure for doing this is simply to remove the hexagon nut, then take the screwdriver and take a turn or half-turn on the seat adjusting screw. This puts tension on the spring which holds the seat and nozzle in alignment. This feature has been worked out because of the tendency of the regulator seat to gradually bear down in service, resulting in a leaky condition, which is very bothersome to an operator. The construction illustrated makes possible a quick adjustment or a rapid replacement of the seat in case it is worn to the point where further adjustment is not desirable.

STORTS WELDING SHOP HAS ANOTHER NEW ONE

Storts Welding Shop in Meriden, Conn., believes in taking advantage of unusual ideas for advertising. Their latest piece of literature is mailed in a large size envelope; inside of this are a series of envelopes decreasing in size, one inside the other and each one carrying in place of an address one or two good business or personal mottoes. The size of the envelopes decreases until the last one is just big enough to hold a mall card, about 3 inches by 2 inches. On this is printed the question, "When are you going to have us do your welding? That's our Work. Storts Welding Company."

QUASI-ARC PRODUCTS NOW HANDLED DIRECT

H. E. Steinbock, who has for some time been handling the Quasi-Arc line of electric welding machines and coated electrodes, has sold back his interest to the Quasi-Arc Weldtrode Company, Peekskill, N. Y. Quasi-Arc products in the future will be supplied by the latter company.

Welding Tight Seams Quickly

Team Work Between Resistance Seam Welder and Spot Welder Speeds up Production Program of Electric Dishwasher Factory

DAY by day the drudgery of routine housework is being relieved by the development of electrically operated machines for handling the most important duties connected with keeping the home and its furnishings clean, and the family fed. Every housewife is willing to sing the praises of her electrical appliances, and some of them even go so far as to remember the inventors who have conceived the idea of lightening the home burdens. Comparatively few, of course, realize that welding processes play an important part in the manufacture of nearly all, if not all, of these devices, and that without these processes most of the articles they buy would be either more costly or less convenient, or both. One of the latest developments in labor-saving machinery for the home is the electric dishwasher, all the more welcome than a clothes washer because you cannot send your dinner set to the laundry or to the dry cleaning establishment.

This machine has been wanted for years, but it is only recently that satisfactory models have been developed; and welding helped to make them right. The Conover Company, in its factory at 5302 W. 66th St., Chicago, Ill., is turning out a dishwasher that is rapidly gaining popularity, because among other things it is self-cleaning. When the dishes are washed the machine is also washed—the job is finished. Welding helps to make this possible by producing tight seams that will take three coats of vitreous enamel, a finish which is both attractive and sanitary.

The container of the Conover dishwasher is made of rust resisting Armco Metal, finished inside and out with three coats of snow white (glass) enamel. This, together with the effective water action and the use of pure soap suds insures the self-cleaning feature. A drain and sediment trap at the bottom make plumbing connections unnecessary. It is in the fabrication of the container that welding plays such an important part. Electric resistance welding is the process now used in the Conover plant. Their equipment consists of one spot welder and one seam welder, made by the Gib Welding Machine Co. of Bay City, Michigan.

Two pieces of 18 gauge Armco sheet are used to form the container. The shell is first rolled to shape and then tacked along the longitudinal seam three or four times by the spot welder. One pass through the rollers of the seam welder makes a smooth, tight seam in a few seconds. Then it is beaded, as shown in the photograph of a pile of shells waiting to have bottoms welded on. The bottom is pressed to shape with a narrow flange to fit over the outside of the shell. Then the drain with its supporting legs is welded in place. The legs are spot welded to the bottom and the drain itself is welded to the bottom with an oxy-acetylene torch. The bottom is now ready for assembly, and is hammered tightly down over the shell. Again the spot welder is used, this time to tack the two pieces at four or five inch intervals. Then the long end seam is made on the seam welder, which automatically turns and welds this joint in a little over half a minute. It is now literally one piece of metal, because the bottom and shell are thoroughly fused together by the operation. Later this assembly is returned to the spot welder for attaching a bracket through which the drain control lever passes. This is another connection which cannot rust loose or pull off.

Reference to the illustrations in connection with the foregoing description of the production process will indicate how beautifully a spot welder and a seam welder work together in shops where there is an appreciable volume of production of sheet metal products. The spot welder by itself saves

Spot Tacking Side Seam.

Shells Welded and Beaded.

Seam Welding Bottom to Shell.
Below—Shell and Bottom Ready for Seam Welding.

large sums which might otherwise be spent for labor, drilling, punching, rivets, bolts, screws and other items that enter into the cost of fastening different parts of a finished product together in other ways. And when a seam welder is to be used for long, or even short seams, it furnishes a quick and rigid method of tacking that makes the use of jigs unnecessary in many cases.

Electric resistance seam welding, the process which is working so efficiently in the Conover plant, is a logical development of the electric spot welding process, and it has long been known that the process is practical for commercial application. Certain operating difficulties were observed, however, in earlier types of equipment. These failed in some cases to live up to the expectations of the user, with the result that manufacturers became discouraged with their use. Research has continued, in spite of the misconceptions regarding the limitations of seam welding, and has led to the development of several types of resistance seam welders which are capable of handling wide ranges of work on a highly efficient basis.

Dishwashers Ready for Shipment.

Containers Enameled, Ready for Assembly.

One of the most important difficulties encountered in the first attempts to use the resistance weld on continuous seams was that the accumulation of heat caused burning of the stock and pitting of the electrodes. In the type of machine illustrated here, this difficulty is overcome by interruption of the current, the operating speed remaining high, and the mechanism suffering no strain by sudden starting and stopping of the rolls. The welding speed proper to the gauge of stock can be maintained throughout the length of the longest seam. The current is automatically switched on and off and the work requires no more than guiding by the operator along the seam. The machine resembles a large spot welder in appearance, and the electrical equipment and electrical characteristics, aside from the interrupter mechanism are not greatly different from a spot welder. A laminated secondary connects the upper welding wheel directly to the transformer and the same method is used to connect the lower welding horn to the transformer. The upper welding wheel is driven by an electric motor mounted on top of the machine. The speed of this motor is controlled through worm gears and a set of change gears. These provide different speeds at the welding roll for different gauges of material and different kinds of material. Provision is made to quickly change the roll arrangement from the straight seam to the circular seam. In this way the side seam of the dishwasher can be welded and by simply changing the lower arm, which is held in a sleeve, and swiveling the upper roll ninety degrees, it is then possible to weld the bottom to the shell, no further adjustments being necessary because of the uniformity of the stock.

Good results in electric resistance seam welding come not so much from skilful operation as from cooperation between the user and the manufacturer of the equipment at the time of purchase. By careful planning and designing it is possible to secure a class of welding service that is second to no other kind of shop equipment. Further refinements of design, not pertinent to this article, are in process of development and bid fair to extend the field for seam welders.

CLEVELAND Y. M. C. A. WELDING SCHOOL IN NEW QUARTERS

The trade school of the Cleveland Y. M. C. A. School of Technology recently moved to new quarters at 2200 Prospect Ave. Mr. R. K. Randall who was recently appointed Director of the Trade School, continues to take an active interest in the welding course, and reports that manufacturers in the city are showing an increased interest in the work of that department. The "Y" is just winding up a drive for $200,000.00, and Mr. Randall says, "A year from now we will be installed in a new building especially designed for Trade School work where we will have a welding layout which I hope will be second to none for a long time.

WELDING NOW A PART OF CHICAGO PLUMBERS' TRAINING

The need for training in oxy-acetylene welding by plumbing apprentices has become recognized in Chicago to the extent that the subject is now a fixed and important part of the three year course in plumbing which is being given at Lane Technical High School. Mr. George Coleman, the welding instructor, has been teaching that subject at Lane Tech. for several years, and is well qualified to train Chicago's future plumbers in the fundamentals of using the torch.

WIRE BRUSH CLEANS AHEAD OF WELD

A recent development in building up the flanges of rolled steel wheels by automatic electric welding has been brought out by the department of street railways, Detroit, Michigan. Cleaning the flanges ahead of the weld has given better welds without any danger of the welded metal scaling off. Some steel wheels instead of wearing to a sharp flange, requiring them to be built up—wear to a thick flange, with a square back. When this condition is met the flanges are brought back to the standard contour by means of an oxy-acetylene torch. This is mounted on the wire brush motor bracket.

A clean surface for this kind of welding is absolutely necessary, for the metal must be deposited upon a clean surface if it is going to give the maximum wear. In order to insure a clean surface a circular wire brush is used in connection with an electric motor. This brush cleans just ahead of the point where the welding takes place and it is mounted on an extension of the shaft of a quarter horsepower motor. A hinged adjustment is provided in the motor bracket and a vertical adjustment is made by moving a clamp situated on a 2 inch diameter upright pipe up or down. The swiveling action of the supporting bracket allows for sidewise and in and out adjustment. This motor driven wire brush has proved very successful for this type of work and has greatly increased the efficiency of this operation.

NOT A WELDED JOINT FAILED

Because of the highly flammible nature of their precious contents, every possible precaution is taken around oil storage tanks to prevent fires. Smoking or carrying open flame lights are positively forbidden. Elaborate piping systems for "Foamite" or other fire-fighting compounds are installed; cross connection pipes are installed to draw off oil from the bottom of a burning tank; and an earthen levee is thrown up about each tank to prevent communication of fire from one tank to another if one should collapse or boil over. Even static electricity is guarded against by carefully grounding all metal vessels and lines. Notwithstanding these and many other precautions, tanks occasionally burn, often resulting in great property damage. Recently in southern California lightning struck a 55,000-barrel oil storage tank. The resulting fire was communicated to thirteen other 55,000-barrel tanks, and in addition six 1,000,000 barrel underground reservoirs for crude oil had been destroyed with their contents. The entire area was utterly wrecked, and a total loss.

The pictures show what remained after the fire. A close study of the wreckage was made by engineers representing oil companies, tank builders, pipe and pipe fitting companies, and others. A number of very significant facts were brought to light.

For instance, it was found that the Foamite system piping had failed under the intense heat. Thus it was impossible to smother several small fires in their early stages, fires which later grew into gigantic proportions. The concensus of opinion was that had this piping system remained intact, several of the tanks would certainly have been saved.

Failure of the Foamite piping was characteristic of all screw-coupled piping in the fire-swept area, even that buried under ground. Screwed joints pulled out of the fittings and couplings, other couplings and fittings warped or split, allowing the joints to separate. Many fittings collapsed entirely.

In joints made by oxwelding, however, there was no failure whatever. One photo shows the remains of the pipe connections to a booster pump. Note that all the fitting connections failed, the cast iron ell in the foreground having completely collapsed, yet all the welds in steel pipe remain intact.

In view is shown a 10-in. oil line after the fire. The threaded flange connection at the valve pulled loose but the butt weld a foot away and the oxwelded tee four feet away withstood the fire perfectly.

This fire has served to emphasize again the superiority of the oxwelded joint. It has already been proved times without number that a weld is stronger and more efficient than any other type of joint—that it is leakproof, does not deteriorate with age, and does not corrode as rapidly as the pipe itself.

The experience gained by this petroleum company at such great expense is a lesson that should be heeded by not only the superintendents of other petroleum companies but by factory executives and managers everywhere. Don't take chances with piping installed for fire fighting. Put it in with welded joints. They are dependable in all emergencies.—*From Oxy-Acetylene Tips, by courtesy of the Linde Air Products Company.*

NEW CATALOG OF HOISTS

The Wright Manufacturing Co. of Lisbon, Ohio, have just released a new catalogue, number 11, which is a comprehensive hand book on chain hoists, trolleys, hand cranes and allied equipment. It contains not only cuts and general descriptive matter, but also line drawings giving all dimensions and clearances of their various products.

These Views Show How Welding Can Serve Pipe Installations. The Welded Joints Throughout This Ruin Were All Intact.

NORTHERN NEW YORK SECTION STARTS FALL PROGRAM

The first of the 1926-1927 meetings of the American Welding Society, Northern New York Section, was held at the Pittsfield works of the General Electric Company, September 29. An inspection trip through the plant was held during the afternoon, followed by a dinner at the works restaurant. A technical session was held in the evening, M. H. W. Tobey, of the laboratory, reading a paper on "Electric Resistance Welding," illustrated by lantern slides and exhibits of welded specimens.

STOODY PLANT EXPANDING

In order to meet the proper demands of its rapidly developing business, the Stoody Welding Company has built a steel-covered saw-tooth building on Slauson Boulevard, Whittier, California. The Stoody Company began as a small welding and repair shop in the oil fields in the Whittier district. During the five years of its life it has expanded until now it markets its products, welding rods and welding equipment, in national markets. The building was constructed by the Union Iron Works of Los Angeles.

COMPRESSED GAS MANUFACTURERS' ASSOCIATION BOARD MEETING ND OUTING

The last regular meeting of the Executive Board of the Compressed Gas Manufacturers' Association was held at The Westchester Biltmore Country Club, at Rye, New York, and was followed by a two day outing. The informal outing of association members proved to be a most enjoyable and effective method of discussing the work of the Association and the problems of the compressed gas industry.

The regular meeting of the Executive Board included reports on progress in the publication of a membership directory in an issue of three thousand copies. Care is being taken to provide an attractive and well bound booklet and to distribute this to a list of industrial and technical organizations which will be interested in the products of the members and associate members. The committee in charge of the project was commended for its effective and energetic work.

The Transportation Committee reported that a hearing of the Interstate Commerce Commission would probably be held in October which would include discussion of gas tank car specifications, regulations for the shipment of compressed gases by water and changes in shipping container specifications. Several compressed gases are now being shipped in tank cars made to specifications of the American Railway Association. It is proposed to cover these cars by I. C. C. specifications and the Association is taking active part in considering this proposal in order to insure insofar as practical the adoption of specifications which will meet the needs of the industry and not be unduly restrictive. The Transportation Committee also reported the proposal of the carriers to increase ratings on returned empty gas cylinders in Western Trunk Line Territory. The proposed increase will be strenuously opposed by the Association.

The Test and Specification Committee reported that several well attended meetings had been held for consideration of a general revision of the I. C. C. Specifications which has been proposed by the Bureau of Explosives. The proposed new specifications are being studied in detail by the committee. It is realized that there is need for simplifying the specfications and changing them in some respects to meet new conditions; but in making such changes every care is being taken to prevent the inclusion of any unnecessary restrictions in the specifications and yet provide adequately safe cylinders.

At the meeting of the Board the Kentucky Oxygen-Hydrogen Company, Louisville, Ky., manufacturers of oxygen, hydrogen and acetylene, was elected to active membership, and Mr. Charles L. Gulick, agent for sale of cylinders, valves, and supplies, was elected as an associate member.

Mr. Harrison Bird of the Burdett Oxygen Company, Detroit, Michigan, was appointed to represent the Association at the annual meeting of the National Safety Council. The National Safety Council publishes safety posters and codes relating to the welding industry and promotes safety in other ways. Through membership in this organization the Association has taken part in this important safety work.

The President was authorized to appoint a representative of the Association to act on the joint committee of the American Welding Society and the American Society of Mechanical Engineers appointed to outline the procedure to be followed in an investigation of welded pressure vessels.

Most of those present at the outing following the Board meeting took part in a golf tournament played on the fine course of the Westchester Biltmore. The weather was ideal. Some of the scores weren't—but all enjoyed the opportunity of exhilarating competition with friends in the industry. First prizes were awarded to R. D. Brooks in the Kickers Handicap, T. W. Goodrich for low net score, J. N. Walker for low putting score and H. M. Hooker for low gross score.

The outing was voted a great success and will probably be followed by similar meetings in the future:

The following were present:

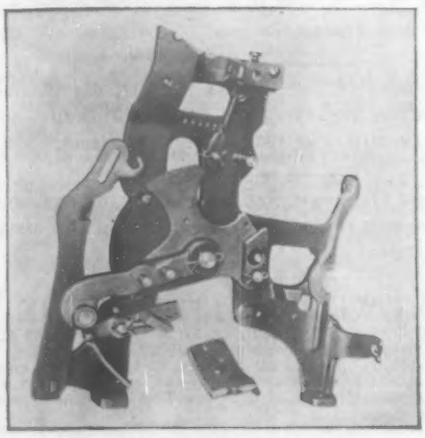
G. D. Bagley, Union Carbide & Carbon Research Laboratory.
H. W. Bates, Pittsburgh Testing Laboratory.
L. A. Belding, American Welding Company.
Henry Booth, Shawinigan Products Co.
R. D. Brooks, Worthington Pump & Machinery Corporation.
R. R. Browning, Linde Air Products Co.
G. O. Carlson, Wm. Wharton Jr. & Co.
H. W. Cole, General Carbonic Co.
J. J. Crowe, Air Reduction Co.
E. A. Doyle, Prest-O-Lite Co., Inc.
C. O. Epperson, Compressed Gas Corporation.
E. A. Faulhaber, Burdett Oxygen Company.
T. W. Goodrich, Union Carbide & Carbon Co.
C. L. Gulick, Wm. Wharton Jr. & Co.
L. W. Hench, American Oxygen Service Co.
Elon H. Hooker, Hooker Electrochemical Co.
H. M. Hooker, Hooker Electrochemical Co.
F. A. Johnston, S. S. White Dental Mfg. Co.
J. A. Kienle, Mathieson Alkali Works, Inc.
F. J. King, Linde Air Products Co.
S. B. Kirk, Linde Air Products Co.
W. B. Leach, Mathieson Alkali Works, Inc.
E. G. Luening, Kentucky Oxygen-Hydrogen Co.
J. H. Luening, Compressed Gas Mfrs. Assn.
H. M. Mabey, Mathieson Alkali Works, Inc.
T. H. Markillie, Linde Air Products Co.
J. C. Minor, Lieber Minor Co.
J. A. Mooney, New England Compressed Gas Co.
J. V. Muller, Roessler & Hasslacher Chemical Co.
R. L. Murray, Hooker Electrochemical Co.
C. R. Oviatt, Union Carbide & Carbon Co.
H. B. Pearson, Burdett Oxygen & Hydrogen Co.
J. N. Pomeroy, United Oxygen Mfg. Co.
R. J. Quinn, Mathieson Alkali Works, Inc.
E. E. Radcliffe, Linde Air Products Co.
P. Samuel Rigner, Roessler & Hasslacher Chem. Co.
H. S. Smith, Prest-O-Lite Co., Inc.
Edwin Thayer, United Oxygen Mfg. Co.
Herman Ullmer, Linde Air Products Co.
R. A. Sossong, Air Reduction Co.
J. N. Walker, Linde Air Products Co.

FINE EXHIBITS OF FINISHED WORK AT BUFFALO MEETING OF AMERICAN WELDING SOCIETY

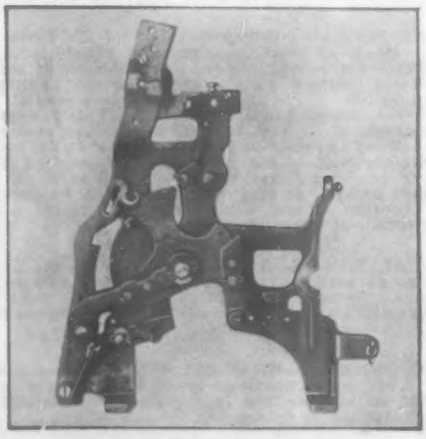
Reports so far received from Buffalo indicate that the fall meeting of the American Welding Society and the exhibition to be held in connection with it should be a complete success and well worth the time spent to everybody who attends. The program of technical papers includes a number of subjects which are of such interest to everybody concerned with welding that they are bound to bring forth some very valuable discussions. In the exhibition room itself manufacturers are competing with each other to furnish the most interesting demonstrations of welding apparatus in operation. Some of the devices shown will be altogether new to the industry and will suggest to the visitors some new opportunities for putting the welding proces to work.

A unique feature of the exposition will be the display of materials which have been fabricated by welding. Two spaces, each 25 feet by 84 feet have been set aside for the purpose of exhibiting welded articles and no charge for space is made to manufacturers who send their products to the exhibit for this purpose. In fact, an invitation has been extended to manufacturers of welded products to send samples to the exposition. Complete details and instructions for shipping can be obtained by writing to Mr. Robert Siemer, c/o The Allen Manufacturing and Welding Company, Buffalo, N. Y.

TOBIN BRONZE WELDING
makes emergency repairs permanent



A bad break in the cast iron parts of an automatic machine—



—welded with Tobin Bronze without dismantling

WHEN a break occurs in an automatic machine, the shop is often confronted with a loss in production while a new part is being obtained. This may take days or even weeks. In the meantime every effort is made to keep the machine in operation. Even makeshift and temporary repairs are often resorted to, to prevent a shutdown.

Tobin Bronze Welding by the oxy-acetylene process offers a most effective solution of such difficulties. It provides the element of speed demanded of emergency repairs and at the same time it makes the repair permanent. It prevents loss of production, and saves the cost of new parts.

The photographs show a typical example of a permanent repair made quickly with Tobin Bronze. Since extensive pre-heating was not required, dismantling was unnecessary. The low welding temperature of 1650° F. also prevented shrinkage and made it possible to restore the broken parts to their original alignment.

Most important of all, the repair is permanent and the weld is stronger than the original cast iron.

Tobin Bronze Welding Rods, exclusively an Anaconda product, are made solely by The American Brass Company, and "Tobin Bronze" is stamped in the metal.

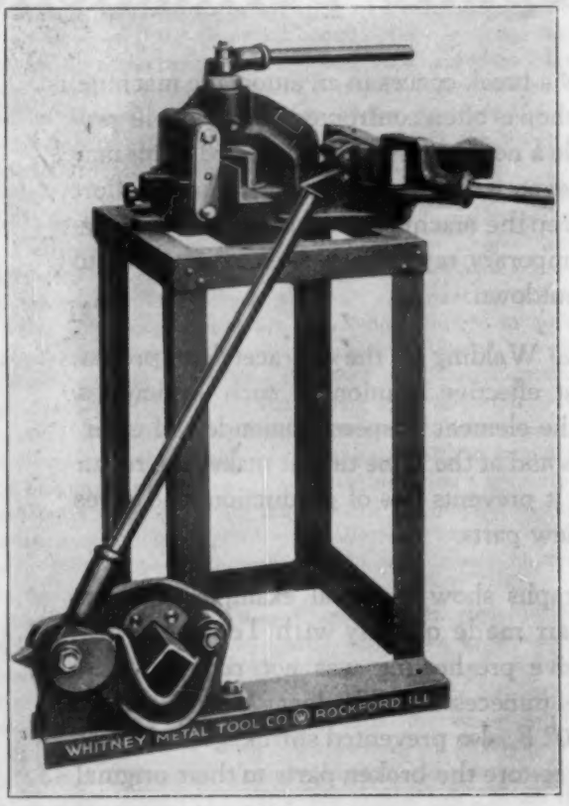
THE AMERICAN BRASS COMPANY
GENERAL OFFICES: WATERBURY, CONNECTICUT
Offices and Agencies in Principal Cities
Canadian Mill: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

TOBIN BRONZE
REG. U.S. PAT. OFF.
WELDING RODS

EXCLUSIVELY AN ANACONDA PRODUCT

A HANDY DEVICE FOR THE WELDING SHOP

At one of the industrial expositions recently held in Chicago demonstrations were given of a line of equipment for notching and bending angle iron. This equipment is made by the Whitney Metal Tool Company, 91 Forbes Street, Rockford, Illinois. With this outfit it is the work of only a moment to cut a 90 degree notch in one side of an angle iron and then bend the member so as to form a perfect right angle. This device would be very useful in a number of



Whitney Angle Iron Machine.

welding shops where considerable attention is given to the fabrication of a variety of products from angle iron shapes. Using this device to cut and bend frames for tables, benches and the like it would be a matter of just a few minutes welding to produce a finished product which would be both sturdy and accurately shaped. The machine illustrated is just one of several items in a complete line of angle iron machinery made by the Whitney company.

NEWS OF THE WELDING TRADE

It is reported that the Kansas Oxy-Acetylene Gas Company having erected for them an Oxeco air liquefaction plant by Keith Dunham Company at Chicago. The location of the new plant is Wichita, Kan.

The Acme Oxygen Company, of Chicago, Ill., recently announced the appointment of C. W. Steele as sales representatiive. Mr. Steele has formerly been representing the Modern Engineering Company of St. Louis in Chicago.

W. I. Brockson, advertising manager of the Steel Sales Corporation, contributed to a recent issue of the Iron Trade Review an exceptional piece of blank verse entitled "I Am the Steel Salesman." As the title implies, it is a tribute to the important part which the steel salesman plays in industry and civilization.

The New York Welding Supply Company, of New York City, is now located at 52 Vanderbilt Avenue, with warehouse at 85 Grand Street. Increased business has enabled them to move to larger and more central quarters.

It is reported that the Williams Welding Company has been incorporated at Charleroi, Pa., by C. J. Morgan, Edward Williams and Charles Bateman, for the operation of a welding plant.

G. E. Harke, of the Air Reduction Sales Company, read a paper on oxy-acetylene welding Thursday evening, September 9th, at Worcester, Mass., before the local chapter of the American Society for Steel Treating.

The Cleveland office of the Purox Company, manufacturers of welding and cutting apparatus and supplies, recently moved to new and larger quarters at 1255 Marquette Street.

The International Oxygen Company reports the payment of the regular semi-annual dividend of 3 per cent on all outstanding stock of the company on October 15th.

CURRENT WELDING LITERATURE

WELDING FACTS AND FIGURES, by D. Richardson and E. W. Birch—A chapter from a forthcoming handbook for welding engineers. Contains definitions and discussions of the terms: specific heat, sensible and latent heat, quantity of heat, melting point, ductility, malleability, elasticity, and stress.—The Welding Journal, London, September.

SHOP PRACTICE IN WELDING—Construction of jigs and fixtures and other ingenious devices for taking care of some of the mechanical problems involved in welding. Particular reference is made to tank work and pipe work.—The Welding Journal, London, September.

OXY-ACETYLENE TIPS—Monthly publication of the Linde Air Products Company. In the October issue the first article tells how proper design accomplished savings in the construction of welded steel hoppers. Detailed instructions are given for the welding of cast aluminum. An article on cutting describes some special jobs done by a manufacturer of well drilling equipment. This is followed by an outline of methods of testing the skill of welding operators. A five page article tells of the uses of bronze welding and gives instructions for applying bronze. A story is told of how welded joints stood up when other types of joints were destroyed in a big fire. Readers are cautioned to have apparatus repairs made by someone who knows how. Another article tells how dipper teeth can be reclaimed by using scrapped locomotive tires.

MAKING VERTICAL WELDS—Attention is called to the necessity for knowing how to make vertical welds in such jobs as the construction of tanks. Some of the difficulties of this work are pointed out and suggestions are made for making the work easier.—Revue de la Soudure Autogene, September.

A GAS WELDED CENTRAL HEATING SYSTEM—Description and illustrations of a hot water heating system in which the boiler itself was all-welded as well as the piping and the radiators.—Revue de la Soudure Autogene, September.

AUTOMATIC ARC WELDING—A new 24 page bulletin just issued by the Lincoln Electric Company, Cleveland, Ohio. The booklet gives detailed description and illustrations of the automatic welding equipment made by the Lincoln Company and its various applications to production work. Diagrams show the principles of the carbon electrode process as applied to automatic welding and there is a full discussion of the merits of the carbon electrode process for this work. Tables give the speeds of welding with different types of joints and different thicknesses of material.

MODERN DEVELOPMENT OF OXYGEN PRODUCTION FROM THE AIR, by C. R. Houseman—A discussion of some of the changes which have been made in plants for the production of oxygen by the air liquefaction process.—Acetylene Journal, October.

SUPERHEATING THE GASSES USED FOR CUTTING—Comments on some experiments which have recently been made with a new type of cutting torch, indicating that there is need for further research before definite conclusions can be drawn.—Acetylene Journal, October.

STELLITING OF WEARING PARTS IN CEMENT MILLS—An 8 page booklet describing the various cases in cement mills where it is desirable to apply stellite to parts which are subject to heavy wear. Illustrations show the application to dipper teeth, roll crushers, hammers, etc.

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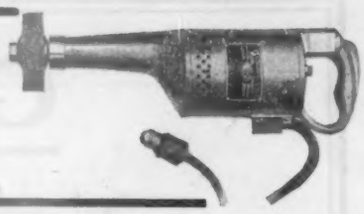

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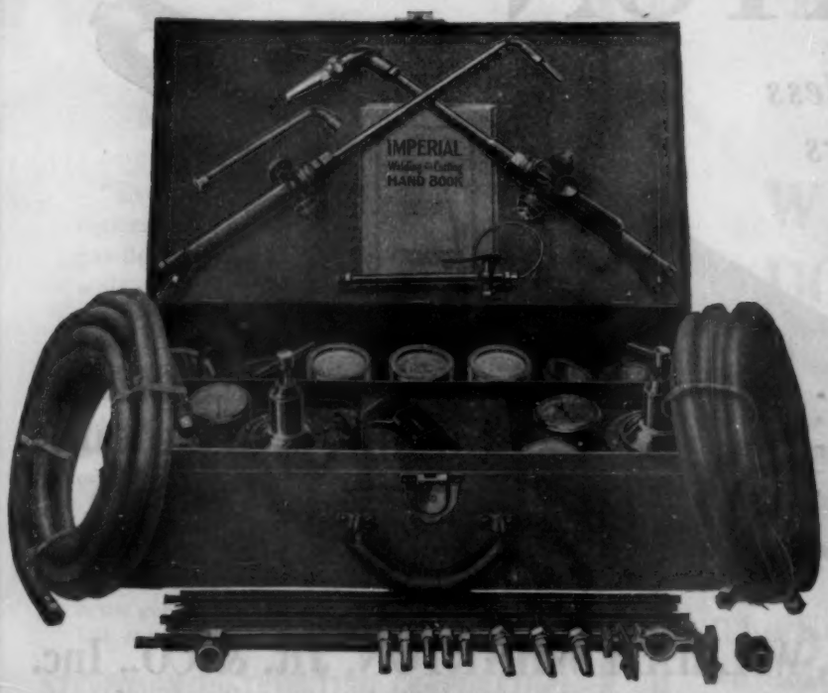

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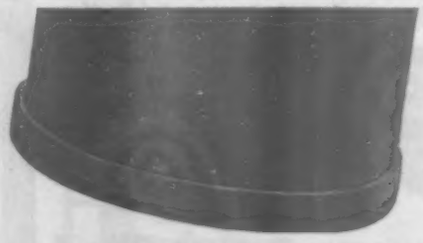

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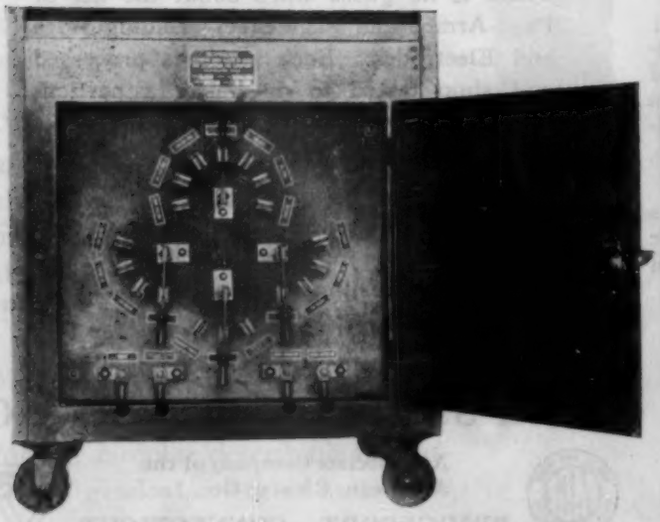

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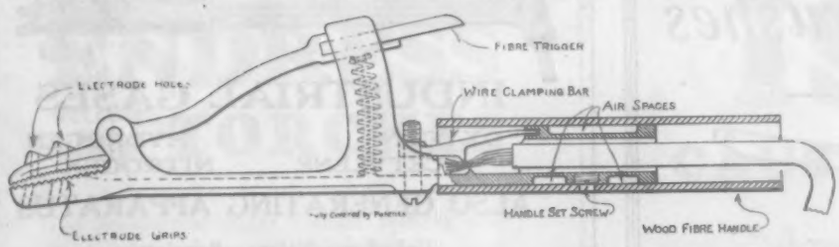

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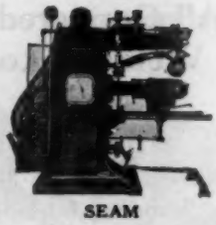

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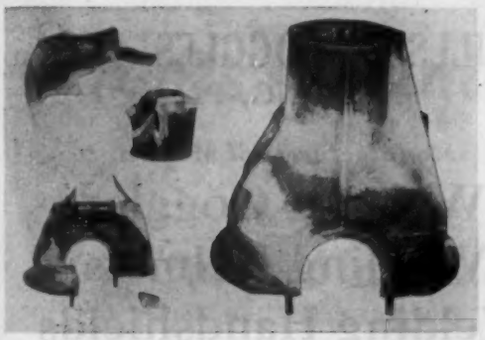

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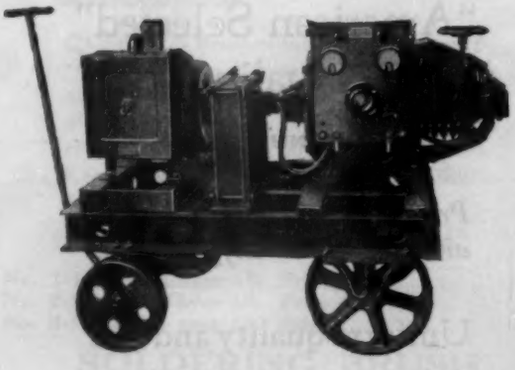

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126 Green St. Newark, N. J.

The new improved Seneca Electric Arc Welder

Lowest First Cost!
Lowest Operating Cost!
Greatest Efficiency!
and
Greatest Simplicity of Operation!

The New Improved Seneca embodies all the time-proven superior features of former models with *many improvements* that places it absolutely in a class by itself.

A small cash payment will bring a complete outfit to your shop. Our new convenient financing plan enables you to take up the balance out of your increased profits.

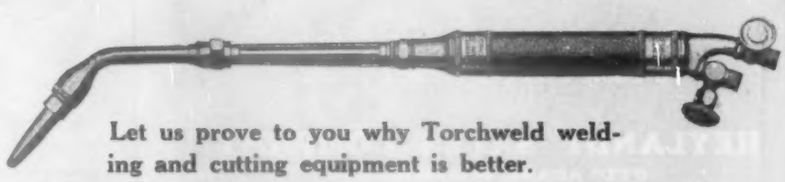
Ask us to give you full information, prices, terms, etc.

Seneca Electric Arc Welder Co.
Seneca, Kansas

You Can Do It Better With TORCHWELD

Operators Know

Operators swear by (not at) Torchweld Non-Flash Welding and Cutting torches—because they are original in design, properly balanced, reliable and always safe in operation.



Let us prove to you why Torchweld welding and cutting equipment is better.

Ask the Operator—He knows:

TORCHWELD EQUIPMENT COMPANY 224 North Carpenter Street, CHICAGO

Electric Arc Welding Equipment

Transformer Arc Welders (A. C.)
Motor Generator Sets (Direct Current)
Gasoline Engine Generator Sets (D. C.)

A complete line of Electric Welding Accessories always carried on hand.
Electrodes—Holders—Masks—Handshields—Glasses—Cables, etc., etc.

ALLAN MANUFACTURING & WELDING CO., INC.
726 WASHINGTON STREET BUFFALO, NEW YORK

Central New York Representative, Endress Manufacturing Company, Cortland, N. Y.

ACME SPOT WELDERS

FOR speed of production, low operating cost and the quality of their work ACME SPOT WELDERS cannot be equalled. Many exclusive and patented features, which greatly increase their ease and speed of operation, are reducing manufacturing costs for hundreds of users throughout the country.

Built in various styles and sizes to meet every welding requirement. Write our nearest office for full particulars.

LOWEST IN PRICE **HIGHEST IN EFFICIENCY**

ACME ELECTRIC WELDER COMPANY

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Welding Carbon Products

National Round Welding Carbons
National Welding Carbon Plates
National Welding Carbon Paste
National Welding Carbon Flour

Our welding carbon products are designed especially for welding operations

National Carbon Company, Inc.
Cleveland, Ohio San Francisco, Cal.
Canadian National Carbon Co., Limited
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99.8% EYE PROTECTION
NOW possible with
IMMUNITE *Lenses*

Made and Supplied by
STRAUSS & BUEGELEISEN
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LIQUEFACTION PLANTS
for the Production of
OXYGEN–NITROGEN
Furnished In Any Capacity from 70 Cubic Feet Per Hour Upwards.

HEYLANDT SALES COMPANY
OTTO ADAMS, General Manager
140 South Dearborn Street, Chicago

ACETYLENE WELDING SHIELDS
Our No. 11 Shield, especially for welders who wear correction glasses. You will enjoy the comfort and freedom afforded by it.

This shield is fitted with "ESSENTIALITE" Welding Glass—The glass you will like. Price, $4.00 each, f.o.b. Chicago, Ill.
Sold by all dealers in welding materials, and manufactured by:
CHICAGO EYE SHIELD COMPANY
2300 Warren Ave., Chicago, Ill.

Anti-Borax WELDING FLUX

"ANTI-BORAX"
Oxy-Acetylene Fluxes
are made for every metal and have EXCEPTIONAL merit.

BRAZ-CAST FLUX
For bronze welding of Cast Iron.

We also make the popular "E-Z" Welding Compound for forge welding.
Samples of any upon request.

Anti-Borax Compound Co., Ft. Wayne, Ind.

AMERICAN COMPOUND CO. MAPCO BOSTON, MASS.

Case Hardening Compound

WELDING SUPPLIES
Electric Welding Wire
High Silicot Cast Iron Rods
MAPCO Norway Iron Rods
MAPCO Steel Rods
Vanadium Rods
Tobin Bronze Rods
MAPCO Brazing Wire
Aluminum Rods
Welders Goggles

FLUXES
Aluminum Solder
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Iron Metallic Filler
Cast Iron Flux
Anti Borax Fluxes
Superior Brazing Compound
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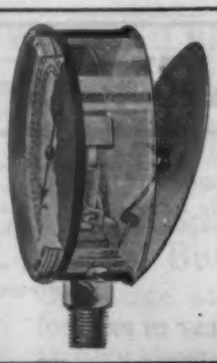
AMERICAN COMPOUND CO.
383-385 ATLANTIC AVENUE, BOSTON, MASS.

RIVETLESS CONSTRUCTION.
"Quasi-Arc"
ELECTRODES & PLANTS FOR WELDING IRON & STEEL
USED BY THE LEADING SHIPBUILDERS ENGINEERS & COLLIERIES OF THE WORLD
THE QUASI-ARC WELDTRODE COMPANY INC.
PEEKSKILL. NEW YORK.

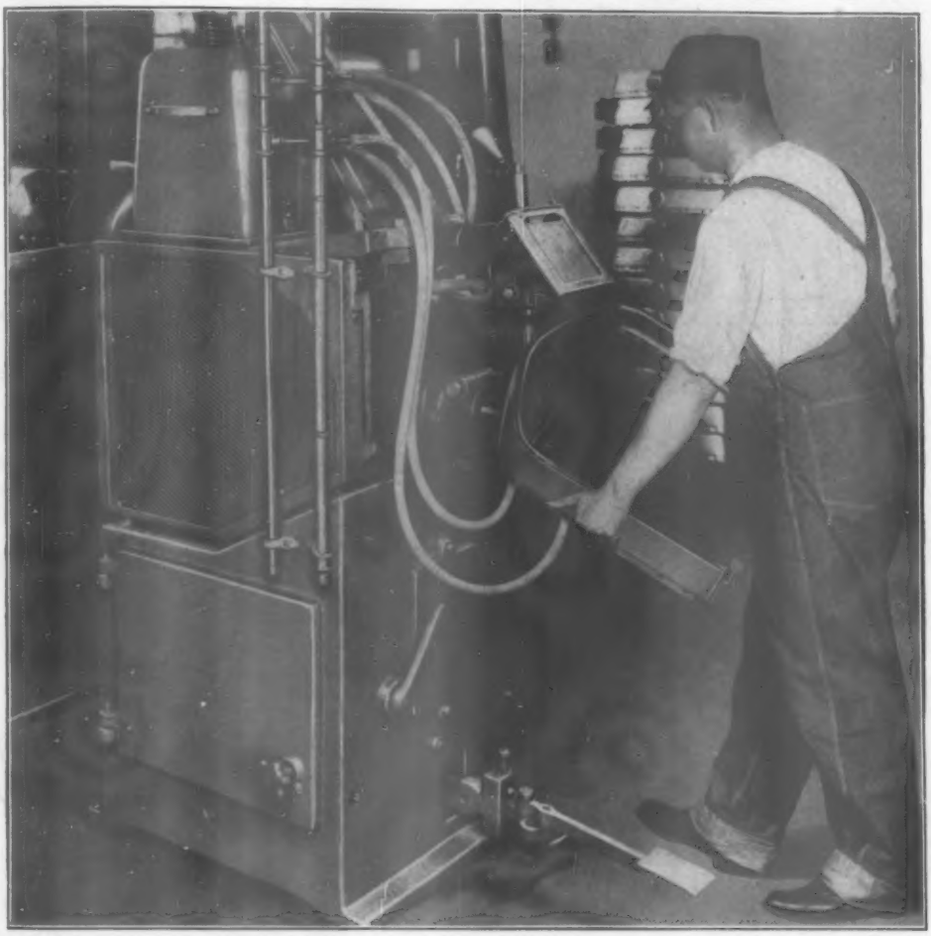


U. S. GAUGES
"AS accurate as a U. S. GAUGE", is high praise indeed, for few instruments of precision can reach such a standard as we have set for ourselves.

Pressure and Vacuum Gauges
All sizes and types for every purpose

UNITED STATES GAUGE CO.
44 Beaver St. New York

FACTS TALK No. 5



This photograph pictures a radiator-shell spot welding operation in the factory of a leading manufacturer of low priced cars.

THESE shells are of brass sheet, and hence, before Elkonite electrodes were tried out presented almost unsurmountable difficulties. There are 8 welds to every radiator shell. Each machine welds 2000 shells daily, making a total of 16,000 welds. Under these conditions of service one Elkonite Rod Electrode makes upward of 400,000 spot welds before replacement is necessary.

This is one of the many instances in spot welding brass, aluminum, galvanized and tinned iron where Elkonite alone can make the operation practicable commercially. Elkonite not only does this but proves itself amazingly economical in terms of time, labor, production and material costs.

Why not investigate the possibilities of Elkonite Electrodes in connection with your welding problems. The Elkon Laboratories are at your service.

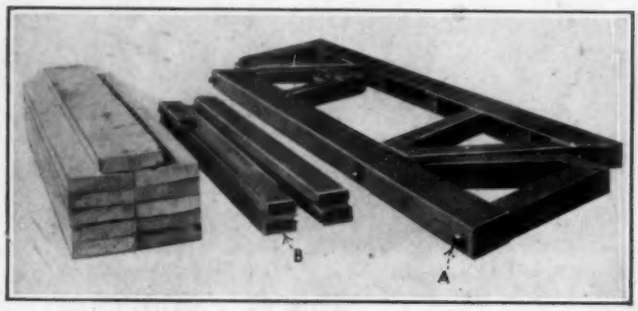
ELKON WORKS Inc.
Subsidiary of P. R. Mallory & Co. Inc.
Weehawken, N. J.

Exclusive licensees under General Electric Co., patents dated May 28, 1925 and Sept. 1, 1925. Other patents pending to Elkon Works, Inc.

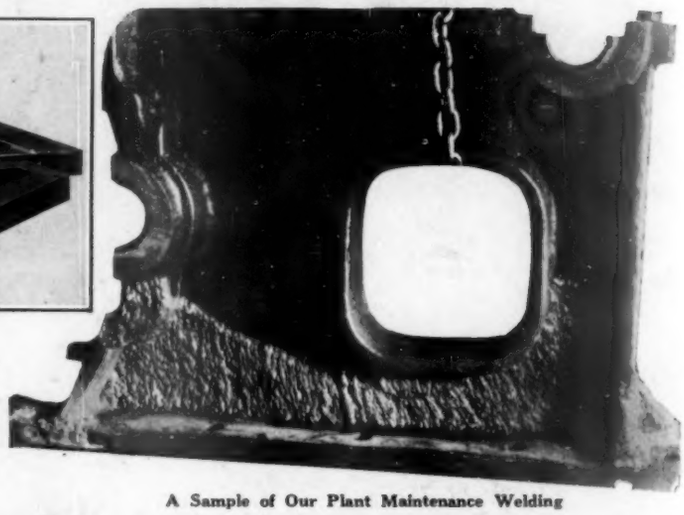
ELKONITE WELDING ELECTRODES

For Both Production and Repair Work--

Use Arc Welding!



Plant Production Welding Done With Our Equipment



A Sample of Our Plant Maintenance Welding

Our Line of Welding Equipment is Complete

Alternarc "Commercial" Welding Transformer

This transformer is designed for all iron and steel welding. Its capacity is 200 amperes. Can be made to operate from any power supply A. C. or D. C.

Alternarc "Industrial" Welding Transformer

Made in two sizes, 275 amperes and 400 amperes. The smaller size is suitable for all careful continuous welding, industrial, shipbuilding or railway work. The larger size, a combination cutting and welding machine, is especially adapted to piece work, structural jobs where intensive welding is employed. Machines furnished with single, two or four arc equipment.

Alternarc Cutting Machines

$350 Special 110 Volts
Complete, all accessories

These machines embody the best process yet developed for rivet cutting, cutting of non-ferrous metals and car scrap. The most popular unit is our two arc machine, 600 amperes per arc for rivet cutting, combined into 1200 amperes for heavy scrap cutting.

Dualarc Generators

This generator, made for one, two, four or six arcs, has the following exclusive features:

1. Both Alternating and Direct Current for all arc welding. Our A.C. Current is also very handy for pipe thawing in the winter.
2. Series differential field for 20 volt metallic arc and series compound field for 40 volt carbon arc. The compound arrangement is very useful where great penetration is desired such as for overhead welding, or welding in a shallow corner or Vee.

3. Ball-bearings, interpole, commutating field and shaft extension.
4. 110 or 220 volts provided for lights, drills, grinders, etc.
5. Automatic Reactor Spring adjusted for all arc welding.

The Dualarc motor generator is portable and has single arc unit. It is extensively used for railroad, industrial and general arc welding.

The Dualarc gas engine set is a complete power house for all arc welding. It also thaws water pipes, does lead burning, operates electric hammers, drills, chippers, grinders, etc. In addition it furnishes illumination or electric power A. C., or D. C. for any job.

Resistor-Reactor

This arc welding regulating apparatus is designed for firms who have their own D. C. power supply at 110 or 220 volts.

ELECTRIC ARC CUTTING & WELDING COMPANY

Apparatus, Electrodes & Every Accessory For Arc Welding

152-156 Jelliff Ave. -- NEWARK, N. J.

ELECTRIC ARC CUTTING & WELDING Apparatus is built according to the standards of the American Institute of Electrical Engineers and receives the approval of the Underwriters' and is on their list of approved welding apparatus.

PRODUCTS

"ALTERNARC" Welding Transformers, "DUALARC" Welding Generators, Generators and Transformers for electric arc cutting, NEWARC Flux Coated Electrodes, Helmets, shields, brushes, gloves, aprons, leggings, cable, handles, electrode holders for all welding and cutting operations.